RUHRPUMPEN S.A.
Monterrey N.L. - MEXICO

Installation, Operation and Maintenance Manual

VTP TR PUMP

Date of edition 08.08.07

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1 General

These operating instructions contain important information about the installation, operation and service of the machine. It is therefore imperative that these operating instructions be read before installation and commencement of operation by the installing engineer as well as by the responsible specialist/operating personnel. They must always be available in the operational area of the machine/plant.
Please contact us should problems arise. The pump may only be opened by us during the guarantee period.

Please have the following information ready in the case of queries:

- The order number and the type designation of the pump. You can find both of these on the first page of these operating instructions or on the rating plate fixed to the pump.
- When ordering spare parts we would further request that you give the description of the required parts, together with their part numbers and identity numbers. You can find these on the sectional drawing and spare part list enclosed.

1.1 Operational data

Pumping medium		Sea water
Density	(kg/m^3)	1025
Temperature	(°C)	30
Q	(m^3/h)	5400
H	(m)	20
n	(1/min)	890
P	(kW)	359,1
Hü (minimum water level)	(m)	2,2
Impeller diameter	(mm)	660/ 540
Testing pressure	(bar)	10

1.2 Operating materials

Thrust bearing		Lubricating grease
Grease type		DIN 51825/ NLGI class 2
max. temperature	(°C)	80
Quantity by first filling	(Gram)	235
Quantity by regreasing	(Gram)	65
Guide bearing		Medium-lubricated

2 Safety

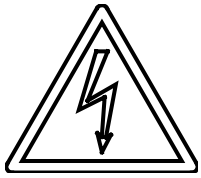
This operation manual gives basic instructions which are to be observed during installation, operation and maintenance of the pump. It is therefore imperative that this manual is read and realized by the responsible personnel/operator prior to assembly and commissioning. It is always to be kept available at the installation site.
It is not only the general safety instructions contained under this main heading safety that are to be observed but also the specific information provided under the other main headings.

2.1 Identification of safety instructions in the operating manual

Safety instructions given in this manual non-compliance with which would affect safety are identified by the following symbol:

see DIN 4844-W9

or where electrical safety is involved, with



see DIN 4844-W8

specially inserted.

The symbol

is inserted in safety instructions whenever non-compliance might endanger the machine or its function.

It is imperative that signs affixed to the machine, e. g.

- arrow indicating the direction of rotation or
- symbols indicating fluid connections

have to be observed and kept legible.

2.2 Qualification and training of operating personnel

The personnel responsible for operation, maintenance, inspection and assembly must be adequately qualified. Scope of responsibility and supervision of the personnel must be exactly defined by the plant operator. If the staff does not have the necessary knowledge, they must be trained and instructed, which may be performed by the machine manufacturer or supplier on behalf of the plant operator, moreover, the plant operator is to make sure that the contents of the operating manual are fully understood by the personnel.

2.3 Hazards in the event of non-compliance with the safety instructions

Non-compliance with the safety instructions may produce a risk to the personnel as well as to the environment and the machine and results in a loss of any right to claim damages. For example, non-compliance may involve the following hazards:

- Failure of important functions of the machine/plant.
- Failure of specified procedures of maintenance and repair.
- Exposure of people to electrical, mechanical, chemical and thermal hazards.
- Endangering the environment owing to hazardous substances being released.

2.4 Compliance with regulations pertaining to safety at work

When operating the pump, the safety instructions contained in this manual, the relevant national accident prevention regulations and any other service and safety instructions issued by the plant operator have to be observed.

2.5 Safety instructions relevant for operation

- If hot or cold machine components involve hazards, they must be guarded against accidental contact (Attach warning signs).
- Guards for moving parts (e.g. coupling) must not be removed from the machine while in operation (Mounting must be possible only with tools).
- Any leakage of hazardous (e.g. explosive, toxic, hot) fluids (e.g. from the shaft seal) must be drained away so as to prevent any risk to persons or the environment. Statutory regulations are to be complied with.
- Hazards resulting from electricity are to be prevented (see for example, the VDE specifications and the bye-laws of the local power supply utilities).

2.6 Safety instructions relevant for maintenance, inspection and assembly work

It shall be the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is performed by authorized and qualified personnel who have adequately familiarized themselves with the subject matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill, it being imperative that the procedure for shutting down the machine described in this manual be followed.

Pumps and pump units which convey hazardous media must be decontaminated.

On completion of work all safety and protective facilities must be reinstalled and made operative again.

Prior to restarting the machine, the instructions listed under „Initial Commissioning“ are to be observed.

2.7 Unauthorized alterations and production of spare parts

Any modification may be made to the machine only after consultation with the manufacturer. Using spare parts and accessories authorized by the manufacturer is in the interest of safety. Use of other parts may exempt the manufacturer from any liability.

2.8 Unauthorized modes of operation

The reliability of the machine delivered will be only guaranteed if it is used in the manner intended, in accordance with clause 1; of this manual. The limit values specified in the data sheet must under no circumstances be exceeded.

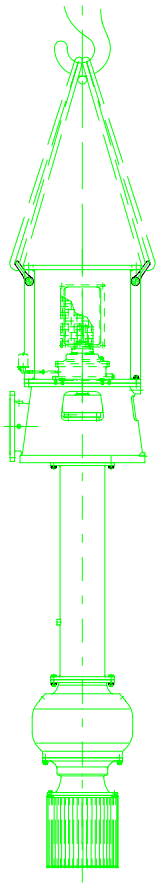
3 Transport and Storage

3.1 Transport

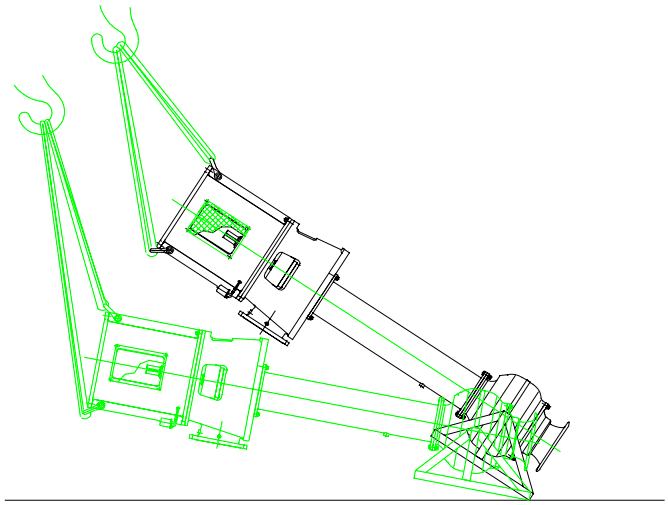
Transported materials must be handled with care to avoid damage. The must be placed carefully on a level floor.
Observe the markings for centre of gravity, the rope attachment points and the access positions for fork lifts.

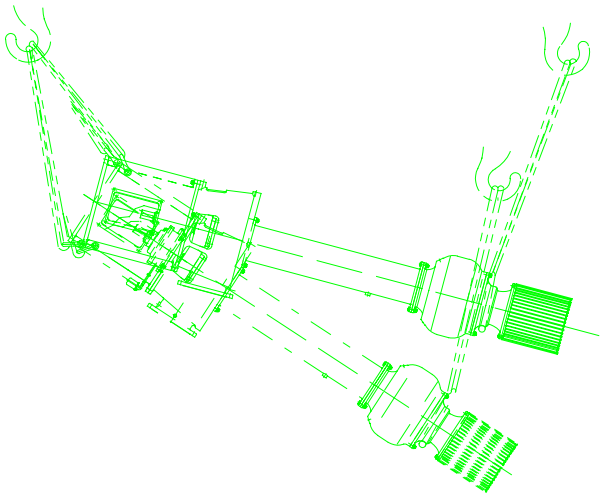
The rope must be attached to the assigned rope attachment points during transport with a crane.

The pump weighs approx. 5300 kg.



3.1.1 Tilting the pump with one or two crane hooks





3.2 Intermediate storage

If the unit is not installed immediately after delivery, it should be safely stored.

- Store in a place free of vibrations.
- Check the packaging for damage every 3 months.
- Repair damaged places.

Observance of the requirements laid down in DIN 7716 (Products made from cauotchouc and rubber) is strongly recommended.

3.3 Conservation

All exposed, machined, working surfaces (flanges, seals, surfaces supporting the motor), shaft ends, unpainted couplings and the like have been cleaned and treated with anticorrosive agents. After being cleaned, all parts inside the pump housing have been sprayed with anticorrosive agents.
The period of protection offered by these conservation measures is approximately 18 months, if stored in a dry place.
If stored under unfavourable climatic conditions, this protective period may be considerably reduced.
Should the anticorrosive layer become damaged, it can be rectified by repainting or respraying.
Anticorrosive layers inside the pump housing must be removed with process-neutral solvents before commencing pump operation.
Please follow the safety instructions of the solvent manufacturer carefully!
The anticorrosive layer applied to the exposed parts does not need to be removed before putting the pump into operation.

4 Overall design of the pump

The TR pump is a single-stage, single-flooding centrifugal pump in vertical design with a semi-axial rotor.
The pump is anchored on the foundation with the discharge housing/knee and the underfloor section is immersed in the pumping medium.

A stuffing box packing is installed in the discharge casing/knie as a shaft seal.

The forces created by the pump are absorbed entirely by the grease-lubricated journal- and guide bearing located above the discharge casing/knie.

The shaft line in the underfloor section is supported in medium-lubricated silcon carbide guide bearings.

The underfloor section consists of the pump section and two column pipe segment.

The pump housing, which is fitted with guide vanes, is protected against premature wear by replaceable casing wear rings.

5 Assembly/Installation

Correct and orderly assembly is a prerequisite for trouble-free operation of the unit. We cannot assume any liability for damage resulting from inadequate assembly.

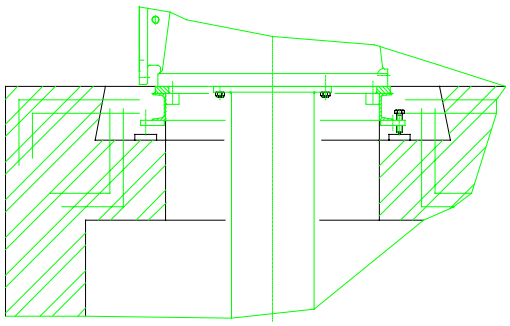
5.1 Foundations

The foundation cavity should be undercut (1:5) for better anchoring of the concrete grouting. Also, the end hooks of the Monier's iron cladding shoul protrude into the cavity.
The following preparations must be made before the equipment is placed on the well-hardened foundation:

- Roughen and clean the surface of the foundation.
- Check the position and the dimensions of the foundation according to the installation plan.

5.2 Alignment

The equipment is placed with the attached foundation frame in the foundation cavity. A distance of around 50 mm should remain between the foundation floor and the foundation ring for subsequent grouting.
The equipment can be aligned to the correct height and system dimensions using the adjusting screws and foot plates.
The foundation cavity is later grouted with the adjusting screws and foot plates.



ATTENTION The alignment of the foundation frame must be performed with the adjusting screws. Wedges must not be used for this purpose.

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5.3 Grouting

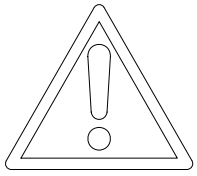
Before grouting the foundation frame, the required height and flange alignment dimensions must be checked and any deviations must be corrected by final adjustment.
The foudation frame is packed with moist concrete or grouted with non-skrinking grouting mortar. Grounting should be performed continuaously and from one side only to prevent cavities from forming under the foundation frame.

5.4 Connecting the piping

Proceed as follows to achieve tension-free connection of the piping:

- Check that the pipes loosened from the pump flange are plane parallel to the flange connection at a distance corresponding to the thickness of the seals, therefore not setting the pump under tension.
- Check that the seals are fitted correctly.
- Connect and tighten the pressure and suction pipes and compare the alignment with the values for fine alignment. If deviations are found, loosen the flange connenctions and remove the seals. Realign the piping plane parallel and concentrically to the pump flange.
- Reconnect the suction and pressure pipes and check the alignment again.

Welding must not be performed on the pipes when they have been connected to the pump.



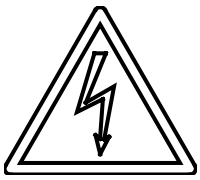
The piping must be connected with utmost care, as otherwise the pumping medium can leak out and cause serious danger to the operating personnel.

6 Start-Up/Closing-Down

6.1 Start-Up

Every time before the pump is started up, the safety devices must be mounted and fastened.

In order to avoid risks resulting from faults, pump units must be equipped with emergency-stop devices.



For operation of electrical drives, of control systems and of their cable routes, the safety instructions issued by the manufacturers of these components must be observed.

6.1.1 Initial Start-Up

Before the pump is started, the following points must be observed:

- Is the direction of rotation of the drive motor in order? The pump's direction of rotation is clockwise when seen from the drive.
- Fill the bearing house with lubricating agents. For quantity and quality details, see section Operating materials.

ATTENTION Before the drive motor is switched on for the control of the direction of rotation, the pump must be uncoupled without fail.

- Is the coupling guard screwed on tightly?
- Close the shut-off device in the pressure pipe.
- Check the shaft seal.

When these conditions have been fulfilled, the drive machine can be switched on. After the operating revolutions have been reached, the shut-off device in the pressure pipe is opened completely.

ATTENTION

The pump may only be operated under the minimum operating range for short periods of time. The minimum pump flow is given in the characteristic line (see section 9).

6.1.2 Monitoring System

During the initial operating hours, the pump should be monitored constantly. It is thus possible to detect irregularities immediately and to take appropriate measures for their elimination (see Section 8).

It must be checked at regular intervals that the safety equipment is undamaged and is arranged and fastened according to the regulations.

When the pump is in operation, attention must be paid to the rotating parts within the freely accessible areas (risk of injury).

For further operation, we recommend that the pump is checked at regular intervals.

The monitoring system for the pump includes:

- Check the temperature of the bearing bracket surface. It should not exceed 80 °C.
- Check that the pumping unit is running quietly and without vibrations. Unusual or too loud noises point towards a possible fault.
- Check the shaft seal (see section 7.6).
- A small remaining leakage is necessary of the stuffing box, in order to lubricate the packing and to dissipate the frictional heat. If the leakage is too great, the stuffing box gland can be tightened. If the leakage is too small, the stuffing box gland must be loosened.

Normal leakage values are:

In the running-in phase approx. 20 to 30 drops a minute, after approx. 24 hours approx. 6 to 10 drops per minute

- Monitor the power consumption of the drive motor.

6.2 Taking out of operation

The following switch-off procedures serve to ensure the safety of the operating and service personnel. They must, therefore, be strictly observed.

- Close the shut-off device in the pressure pipe.
- Switch off the drive motor.
- Observe the run - down of the pump until fullstop.

If the rotor is jerky or suddendly stops, there is a danger that the rotor has become blocked. The pump must be opened and all running clearances checked.

Ensure the drive motor cannot be unintentionally turned on.

Ensure the shut-off devices in the suction and pressure pipes cannot be unintentionally opened.

- Drain the pump and the auxiliary piping.

If the outside temperature is below 0 °C, all cooling chambers must be emptied.

6.3 Shut-down measures

The measures necessary depend on the length of time foreseen for the shut-down.

6.3.1 Short-term shut-down

If the pump has switched off correctly and has not suddenly come to a halt, it may be re-started without the need to take any special measures. If the pump was switched off because of a possible danger, it must be checked for damage.

6.3.2 Decommissioning for long periods

- Switch off the drive motor.

Secure the drive motor against inadvertent activation.

- Close the shut-off valves in the pressure piping.

Secure shut-off valves in the pressure piping against inadvertent opening.

- If the plant is operational, start the equipment at monthly intervals and allow to run warm (see Section 6.1 for details).
- If the plant is not operational, rotate the pump several times by hand at monthly intervals.
- Empty the pump and auxiliary piping if there is danger of freezing.

Before recommissioning, an oil change must be performed (see Section 7 for details).

7 Service / Inspection

To guarantee problem-free operation of the pump unit, it is necessary to carry out regular service and maintenance work.
The necessary control procedures are described in section 6 and involve:

- Lubrication materials,
- bearing temperature,
- quiet running of the pump,
- power consumption of the drive motor and
- shaft seal.

7.1 Bearing lubrication

Any good saponified lithium grease with a soft consistency is suitable for lubricating the bearings.
Lubrication is performed at intervals of 2000 service hours.
When greasing, remove the cap at the bottom of the bearing box to allow excess grease to be discharged. Replace the cap after approx. 1 hour of operation.
As a rule of thumb for the quantity of grease at the first filling: Inner diameter of the bearing in millimetres is equal to the minimum quantity of grease in grammes. The refilling quantity is indicated in the data sheet 1.2. Excessive greasing is just as damaging as grease deficiency.
Sort-term temperature peaks shortly after lubrication are normal. However, the temperature of the bearing measured at the outer wall of the bearing mounting should not exceed 80° after a running-in time of 8 hours.

7.2 Inspection

After 2 years of operation, an inspection should be carried out. The pump must be shut down and opened for this purpose. The dismantling of the pump is described in section 7.3.

The inspection includes the following points:

- Visual check of all individual parts for any damage.
- Check the casing for wear.
- Check the impeller for wear.
- Check the radial clearance for wear in accordance with the running clearance table.
- Clean and check the antifriction bearings.
- Check pump shaft for concentricity; at fitting points, the deviation must not exceed 0,03 mm.
- Clean and check all auxiliary piping.
- Check the transmission elements of the coupling and replace, if damaged (for details, see section 9).

- Check the mechanical seal and the shaft protective sleeve for scoring and replace if necessary.
- Replace packing and check the shaft protective sleeve for scoring and rework, if necessary; the diameter of the shaft protective sleeve must not lie more than 1 mm under its nominal value.
- Replace all gaskets, joint rings and round section joint rings.

Radial running clearances of the pump (average diametral clearance).

	normal		maximal	
Casing wear ring/Impeller ring	0,8	mm	1,6	mm

7.3 Dismantling and assembling the pump

Normal craftman's tools and the usual equipment for removing coupling halves and antifriction bearings are used in the work on the pump. No special tools are necessary.

It is recommended that only original spare parts are used, as a problem-free operation of the pump can only be guaranteed with original parts.
The constructional design can be seen in the sectional drawing 701 613 0509 .1 in section 9.

The described dismantling and assembling of the pump requires, that works are taken place in a workshop done by well trained staff.
Dismantling and assembling of the pump parts at site is possible. In this case, work is taking place at the pump foundation. The Pumpe is assembled step by step from the lower parts and is lowered downwards into the pump sump.
This enables assembling and disassembling of long pumps even when the height of the crane hook is low.

The weight of the pump parts are as follows:

- Complete pump 5300 kg
- Pump shaft (211) 258 kg

- Top shaft (211) 336 kg
- Column pipe (711.01) 400 kg
- Column pipe (711.02) 315 kg
- Motor stool (341) 766 kg
- Delivery elbow (144) 1300 kg
- Bellmouth (138) 300 kg
- Pump bowl (112) 980 kg
- Impeller (230) 200 kg.
- Shell coupling (853) 35 kg.

7.3.1 Dismantling the pump

Switch off the drive motor before beginning dismantling and secure against inadvertent activation. Secure shut-off valves in the pressure and suction piping against inadvertent opening. Decommissioning is described in Section 6.2.

Ensure the stable positions of dismantled components during mounting and dismounting work on the pump. Use supporting equipment if necessary.

The guide bearings of this pump are made of silicon carbide. Silicon carbide is a very hard, brittle material. When mounting the shaft bearings and the pump, axial loads or edge stresses and shocks must be avoided.

The following steps are necessary to dismantle the individual components:

- Remove the coupling guard (681).

- Separate the coupling and remove the drive motor.
- Release the pump from the pressure piping. Mark and remove all auxilliary piping.
- Release the pump from the foundation and withdraw the pump from the pump sump.

All subsequent dismantling work can be continued in a workshop:

- Support the pump on trestles with the discharge flange facing downwards and secure against tilting.
- Remove the bellmouth (138) with the casing wear ring (502).
- Secure the pump shaft (211) against turning.
- Support the pump on trestles with the discharge flange facing downwards and secure against tilting.
- Remove the bellmouth (138) with the casing wear ring (502).
- Secure the pump shaft (211) against turning.
- Loosen the impeller screw (906) and remove the disc (550.01) and the impeller (230).
- Remove the fitting key (940.01) and the spacer ring (504).
- Remove the coupling half from the drive side.
- Dismantle the thrust bearing (see Section 7.5).
- Loosen the fixing screws of the motor stool (341).
- Remove the motor stool (341).
- Remove the sealing unit (see Section 7.6).
- Remove the delivery elbow (144) while supporting the top shaft (213).
- Losen and remove the second column pipe (711.02).
- Dismantle the muff coupling (853) and remove the top shaft (213).
- Secure the pump shaft (211) against axial movement.

ATTENTION If this step is not performed correctly, damage can be caused to the guide bearing when the pump is erected.

- Erect the remaining pump bowl (112) with the column pipe (711.01) and the pump shaft (211) vertically.

ATTENTION The contact surface of the pump bowl flange must be protected from damage. The flange must be supported so that the pump shaft does not lie on it.

- Withdraw the pump shaft (211) from the column pipe (711.01) and the pump bowl (112).
- Loosen and remove the column pipe (711.01) from the pump bowl (112).
- The guide bearings can now be dismantled as described in Section 7.4.

7.3.2 Assembling the pump

Assembly is performed in the reverse order as described in Section 7.3.1. Ensure that all plane surfaces are clean and free from burrs. Check the round true of the pump shaft before assembling. The greatet permissible deviation from round true is 0,03 mm.

- The guide bearing is assembled as described in Section 7.4.
- Erect the pump bowl (112) with the mounted the casing wear ring (502) vertically.

ATTENTION The contact surface of the pump bowl flange must be protected from damage. The flange must be supported so that the pump shaft does not lie on it.

- Screw the column pipe (711.01) vertically onto the pump bowl (112).
- Insert the pump shaft (211) from above into the column pipe (711.01) and the pump bowl (112).

ATTENTION Further steps of assembly should be performed in a vertical position. If this is not possible in the available space, assembly work can be performed in a horizontal position. The following must then be observed:

  - Extreme care is required in handling the bearing.
  - Support all components in danger of bending.

- Secure the pump shaft (211) against axial movement.

- Support the pump on trestles and secure against tilting.
- Mount the top shaft (213) with muff coupling (853).
- Slide the second column pipe (711.02) over the top shaft (213) and screw tight.
- Slide the delivery elbow (144) on the top shaft (213).
- Screw the delivery elbow (144) to the second column pipe (711.02) whilst supporting the top shaft (213).
- Mount the sealing unit (see Section 7.6).
- Mount the motor stool (341).
- Mount the supporting bearing (see Section 7.5).

The assembly of the pump bowl can now proceed:

- Slide the spacer ring (504) onto the pump shaft (211) to its fullest extent.
- Insert the fitting key (940.01) for the impeller (230) in the pump shaft (211).
- Secure the pump shaft (211) against turning.
- Slide the impeller (230) onto the pump shaft (211) and tighten the impeller screw (906).
- Attach the bellmouth (138) with the casing wear ring (502).
- Adjusting the rotor (see section 7.5.3).
- Slide the coupling half onto the drive side.

All subsequent mounting work can be continued at the installation site:

- Lift the pump into the pump sump and fasten to the foundation (see also Section 5).
- Connect the pump to the pressure piping. Attach all auxiliary piping (see also Section 5.4).
- Mount the drive motor and the coupling.
- Mount the coupling guard (681).

7.4 Assembly and disassembly of the guide bearing (medium-lubricated SiC bearing)

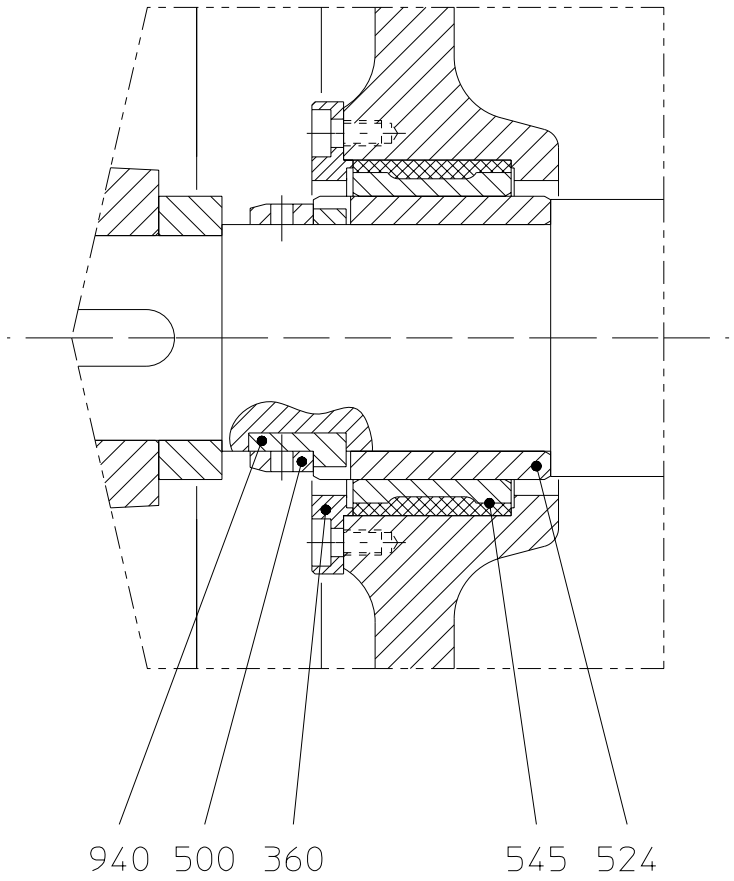
The bearing consists of an externally rubberised silicon carbide bearing box and a protective sleeve of the same material for the shaft.
The bearing is maintenence-free.

7.4.1 Dismantling the guide bearing

- Unscrew the bearing cap (Pos. 360).
- Withdraw the rubberised bearing sleeve (Pos. 545) from the housing and remove existing rubber residues.
- Loosen the threaded pin and remove the ring (Pos. 500).
- Remove the fitting key (Pos. 940).
- Withdraw the protective sleeve (Pos. 524).

7.4.2 Assembling the guide bearing

Assembly is performed in the reverse order. Care must be taken that all plane surfaces are clean and free of burrs.



- Slide the slotted protective sleeve (Pos. 524) with the unslotted end first to its fullest extent onto the shaft.
- Secure the protective sleeve against turning with the ring (Pos. 500) and the fitting key (Pos. 940).
- Secure the ring and the fitting key with the threaded pin using Loctite TYPE 221.
- Insert the externally rubberised bearing box (Pos. 545) into the provided hole in the housing using Loctite Type 307.
- Screw on the bearing cap (Pos. 360).

ATTENTION Silicon carbide is a very hard, brittle material. Avoid radial loads, edge strains and shocks when assembling the shaft bearings and the pump.

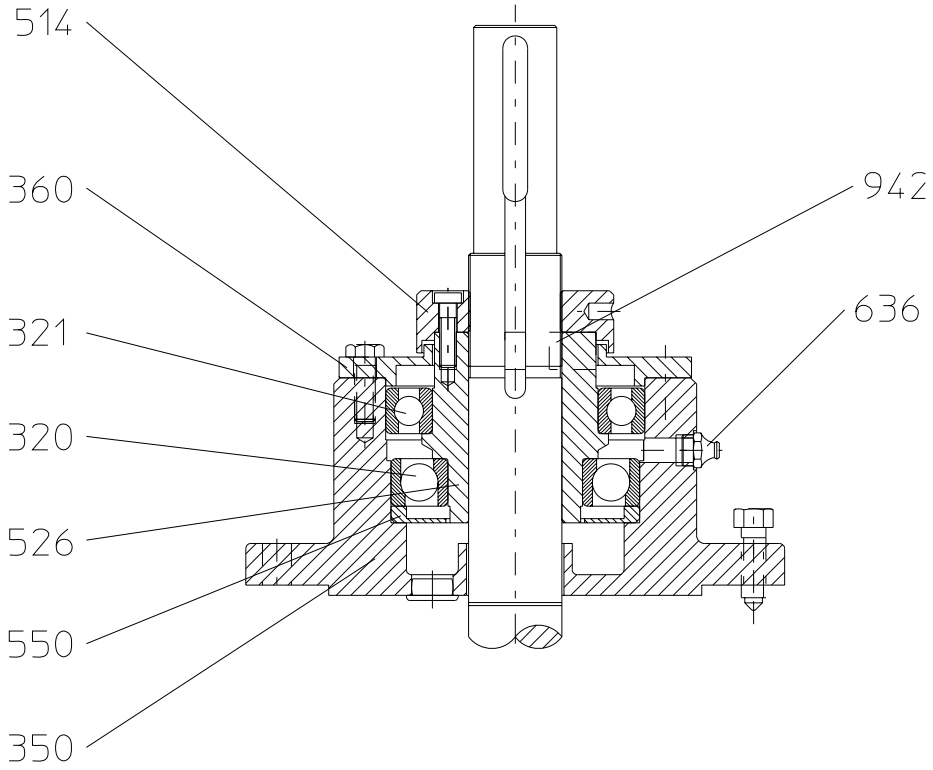
7.5 Assembling and disassembling the supporting bearing (grease-lubricated)

7.5.1 Dismantling the supporting bearings

- Unscrew the threaded ring (Pos. 514).
- Remove the wedge (Pos. 942) from the groove in the shaft and the centering sleeve.
- Loosen the bearing box from the bottom of the drive cage and withdraw from the shaft.
- Loosen and remove the bearing cap (Pos. 360).
- Withdraw the bearing and centering sleeve assembly (Pos. 526) from the bearing house (Pos. 350).
- Remove the inclined ball bearing (Pos. 320) and the radial ball bearing (Pos. 321) from the centering sleeve.

7.5.2 Assembling the supporting bearing

Assembly is performed in the reverse order. Care must be taken that all plane surfaces are clean and free of burrs.



- Heat the inclined ball bearing (Pos. 320) and the radial ball bearing (Pos. 321) in an oil bath to 80 to 90° C and slide onto the cold centring sleeve (Pos. 526) to their fullest extent.

ATTENTION

Ensure that the inclined ball bearing is correctly aligned when fitting (the high edge of the inner bearing ring opposes the edge of the centring sleeve).

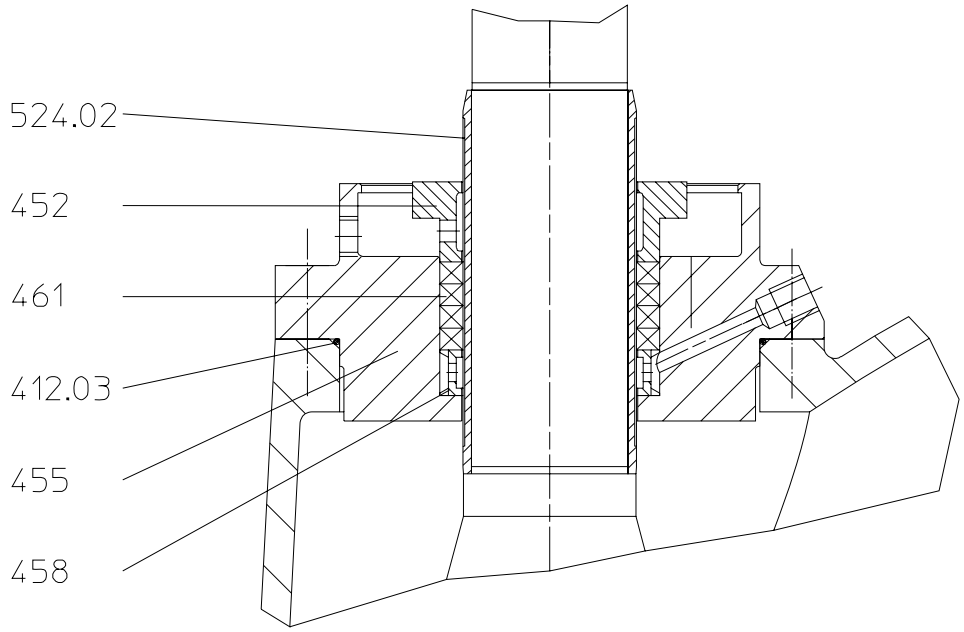
- The chamber between the rolling meter and the chamber between the bearings even must be filled with the indicated quantity of grease (see data sheet 1.2).
- Insert the centring sleeve with the bearings into the bearing box (Pos. 350).
- Screw on the bearing cap (Pos. 360).
- Slide this assembly onto the shaft and fix to the bottom of the motor stool.
- Insert the wedge (Pos. 942) in the groove of the shaft and into the centring sleeve.
- Screw on the threaded ring (Pos. 514) so that its edge grips behind the wedge.

7.5.3 Adjusting the rotor

Loosen the allen screws in the threaded ring. The pump shaft can be moved to its fullest extent in both axial directions by turning the threaded ring. The rotor is then adjusted to a position half way along the total travel. This dimension is indicated in the cross-section drawing. The threaded ring is fastened with the allen screws when the rotor has been adjusted.

7.6 Assembling and diassembling the stuffing box

The pump shaft is sealed at the drive side by a stuffing box. Disassembly and assembly should be performed according to the sectional drawing 701 613 0509 .1 in Section 9.



7.6.1 Dismantling

The following steps are necessary to remove the stuffing box:

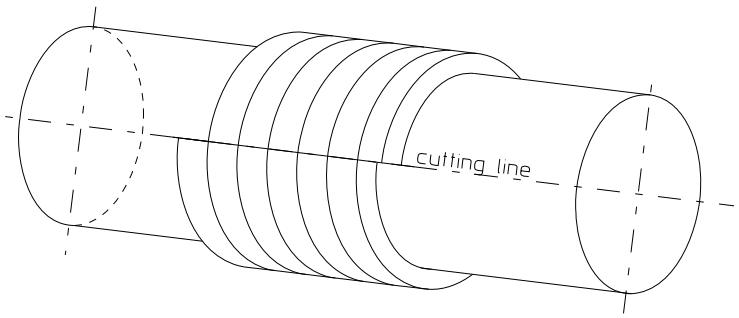
- Remove the allen screws in the stuffing box gland (452).
- Loosen the stuffing box gland (452) and lift upwards.
- Remove the packing rings (461) individually with a tool (packing puller).
- The metal holding ring (458) can be extracted with the aid of a hook wrench applied to the grooves located at its periphery.

7.6.2 Assembling

The stuffing box packings are mounted in the reverse order to disassembly. Ensure that only original spare parts are used. Packing rings can be used with either straight or diagonal-cut edges. The diagonal cut usually provides a better seal during operation. If rings are inserted around the shaft, the cutting edges should be offset by 90°.

If endless material is used, the cross-section dimensions of the packing must conform to those of the stuffing box cavity. The cross section must not be altered by tapping or pressing.

A cutting instrument or a punch are used for cutting.



Residues of packing remaining in the pump must be removed and the surfaces cleaned. The protective sleeve for the shaft must be inspected for wear and replaced if necessary.

Ensure that packing is performed in the same order to ensure that the retaining ring is later provided with a sufficient quantity of retaining medium. Thighten the stuffing box gland lightly and evenly at first. The pump rotor must turn as freely as before the new packing was inserted.

The stuffing box gland is then tightened evenly after approx. 24 hours of running-in time so that the stuffing box only drips slightly.

ATTENTION The remaining leakage is necessary for lubrication, cooling and to reduce the wear on the stuffing box.

7.7 Spare parts

The recommended quantity of spare parts required to meet the conditions of constant operation over a period of two years are given in the list below:

Spare parts	Number of pumps (including reserve pumps)						
	2	3	4	5	6 and 7	8 and 9	10 and more
	Quantity of spare parts						
Impeller	1	1	1	2	2	3	30 %
Casing wear ring, impeller ring	2	2	2	3	3	4	50 %
Shaft with fitting key and shaft screws or nuts.	1	1	2	2	2	3	30 %
Bearing	1	1	2	2	3	4	50 %
Bearing bracket complete with shaft, bearings, etc.	-	-	-	-	-	1	2
Seals for pump casing (Sets)	4	6	8	8	9	12	150 %
Other seals (Sets)	4	6	8	8	9	10	100 %
Shaft sleeve	2	2	2	3	3	4	50 %
Rotating seal ring	2	3	4	5	6	7	90 %
Stationary seal ring	2	3	4	5	6	7	90 %
Round section joint ring	2	3	6	8	8	10	150 %
Seal on stationary seal ring	2	3	6	8	8	10	150 %
Spring	1	1	1	1	2	2	20 %

The spare parts should be available from the time of first operation. Spare parts taken out and used must be replaced as soon as possible. Please give the following details when ordering:

- Order no. of the pump.
- Type of pump and size.
- Identity number from the list of spare parts.
- Part number from the sectional drawing.
- Quantity .
- Material.

Storage of spare parts:

- Store the spare parts in their original packaging.
- Store in a dry place, preferably at a constant temperature.
- Check the spare parts for signs of corrosion and the state of the packaging every 6 months.
- Repair damage to the conservation with anticorrosive agents.
- Observance of the requirements laid down in DIN 7716 (products made from caoutchouc and rubber) is additionally recommended.

Conservation of spare parts:

The conservation of spare parts corresponds to the conservation of the pump. Details can be found in section 3.

8 Technical problems, causes and solutions

The table acts as an overview for any technical problems which might occur and their possible causes. If problems occur which are not included here or which cannot be traced back to the causes given, we recommend that you contact our works.

Problem	**Reference numbers for causes and solutions**
Pump flow too low	1, 2, 3, 4, 5, 6, 7, 8, 9, 17, 18
Differential head too low	2, 3, 4, 5, 6, 7, 8, 9, 17, 18
Differential pressure too high	9, 11
Power consumption of the pump too high	9, 10, 11, 13, 14, 17, 18, 21
Pump becomes hot	2, 5, 21, 22
Pump runs restlessly	2, 3, 4, 5, 6, 8, 10, 13, 14, 20, 21, 22
Raised bearing temperature	13, 14, 15, 16, 21
Shaft seal leaks	12, 13, 16, 23, 24
Pump casing leaks	19

8.1 Causes and measures for their elimination

Ref.-No.	Cause	Solution
1	The counterpressure of the plant is greater than design point of the pump.	Open the shut-off device on the delivery side as wide as is necessary to reach the operating point.
2	The pump or the piping are not properly vented or filled up.	Vent or top up.
3	Feed pipe or impeller blocked.	Clean piping and impeller.
4	Formation of air pockets in the piping.	· Install vent valve. · Possibly lay the piping elsewhere.
5	$NPSH_{available}$ too low.	· Check the fluid level in the feed container. · Open the shut-off device in the feed pipe completely. Lay the feed pipe elsewhere if thefriction losses are too great. · Check possibly installed filter in the feed pipe.
6	Pump rotates in wrong direction.	Change the poles of any two phases on the motor.
7	Revolutions too low.	Increase revolutions (turbine, internal combustion engine). Consultation with our works required.
8	Inner pump parts are worn.	Change worn parts.
9	Density or viscosity of the pumping fluid deviates from the design data.	Consultation with our works required.
10	Differential head is smaller than the nominal differential head of the pump.	Set operating point with the shut-off device in the pressure pipe.
11	Revolutions too high.	Decrease revolutions (turbine, internal combustion engine). Consultation with our works required.
12	Shaft seal is damaged.	Check the parts of the shaft seal and change, if necessary.
13	Pump unit is not properly aligned.	Realign the pump.
14	Pump is under tension.	Check the piping for tension-free connections.
15	Excessive axial thrust.	Clean the balance holes in the impeller and change the sealing rings.

16	The given half-coupling spacing is not set.	Reset. See assembly plan for spacing measurement.
17	The motor voltage is incorrect.	Use motor with correct voltage.
18	Motor only runs in two-phase mode.	· Check the cable connection. · Renew the fuse.
19	Screws are not tight enough.	· Tighten the screws. · Renew the seals.
20	Impeller is unbalanced.	· Clean the impeller. · Rebalance the impeller.
21	Bearing is faulty.	Change the bearing.
22	The minimum flow rate is not reached.	Raise the flow rate to the minimum flow rate.
23	The gland packing is inexpert built-in.	Test the preload and site of the lantern ring.
24	The barrier-, wash- or circulation pipe is clogged.	Testing the pipes at free undersize.

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RUHRPUMPEN

RUHRPUMPEN GmbH
Stockumer Strasse 28
58453 Witten
Germany

DEPARTMENT : 52210
DATE : 18.11.2005
SHEET-NR. : 1/1
AD-NR. : 25839

PUMP TEST SHEET

PUMP DATA

pump typ	: TR 600/4/580	D2a [mm]:	660
project	: 26-1822	D2i [mm]:	540
item	: CW-PP 301	D2m [mm]:	600
manom. suction side	: - Y [m]	DNs [mm]:	0
manom. delivery side:	-1/+5 bar	DNd [mm]:	588
flow measurement	: I D M 13	z [m]:	0
meas. of rot. speed	: photoelectr.	zs [m]:	0
		special feature	: vertical submerged !

MOTOR DATA

manufacturer	: C O N Z	typ	: QUZ 112-6
motor-nr.	: 1 484 409	power [kW]	: 600
speed [1/min]:	980	efficiency [%]:	92
voltage [V]:	6000	current intens. [A]:	74
frequency [Hz]:	50	cos phi [-]:	.85

GUARANTEE POINTS

Number of guarantee points: 1
Rho (guarantee) [kg/dm^3]: 1.025

guarantee point	n 1/min	Q m^3/h	H m	Eta %	P kW	NPSH m	viscosity cSt
1	890	5400.0	20.00	84.00			

MEASURED VALUES

Rho (test) [kg/dm^3]: 1.0000

Nr.	n 1/min	Q m^3/h	ps bar	pd bar	z m	c^2/2g m	H m	Etamot %	Pmot kW	Eta %	P kW	NPSH m
1	989	2470.0	-.196	3.740	0.00	.33	40.45	92.00	531.00	55.73	488.52	
2	989	3410.0	-.196	3.350	0.00	.62	36.77	92.00	541.00	68.64	497.72	
3	989	4325.0	-.196	3.000	0.00	1.00	33.58	92.00	547.00	78.63	503.24	
4	989	5430.0	-.196	2.490	0.00	1.57	28.96	92.00	542.00	85.92	498.64	
5	989	5840.0	-.196	2.180	0.00	1.82	26.04	92.00	528.00	85.31	485.76	
6	989	5970.0	-.196	2.090	0.00	1.90	25.21	92.00	518.00	86.04	476.56	
7	989	6175.0	-.196	1.910	0.00	2.03	23.50	92.00	512.00	83.96	471.04	
8	990	6600.0	-.196	1.600	0.00	2.32	20.63	92.00	497.00	81.15	457.24	
9	991	6960.0	-.196	1.320	0.00	2.58	18.04	92.00	472.00	78.78	434.24	
10	987	1000.0	-.196	4.500	0.00	.05	47.93	92.00	530.00	26.78	487.60	

RESULTS AT SPECIFIED DUTY

Rho (guarantee) [kg/dm^3]: 1.0250

Nr.	n 1/min	Q m^3/h	H m	Eta %	P kW	NPSH m
10	890	901.7	38.97	26.78	366.44	
1	890	2222.8	32.76	55.73	364.91	
2	890	3068.7	29.78	68.64	371.78	
3	890	3892.1	27.19	78.63	375.91	
4	890	4886.5	23.45	85.92	372.47	
5	890	5255.4	21.09	85.31	362.85	
6	890	5372.4	20.41	86.04	355.98	
7	890	5556.9	19.03	83.96	351.85	
8	890	5933.3	16.68	81.15	340.51	
9	890	6250.7	14.55	78.78	322.41	

REMARKS

Bearing housing temperature after 1.5 h running test and maximum vibrations:
temperature [°C]: DE: 35 ambient: 19.5
vibration [mm/s RMS]: DE: hor.: 1.7 tang.: 2.05 axial: 1.4

customer : S H O P T E S T
company : Ruhrpumpen GmbH
duration of test: 1.5 h

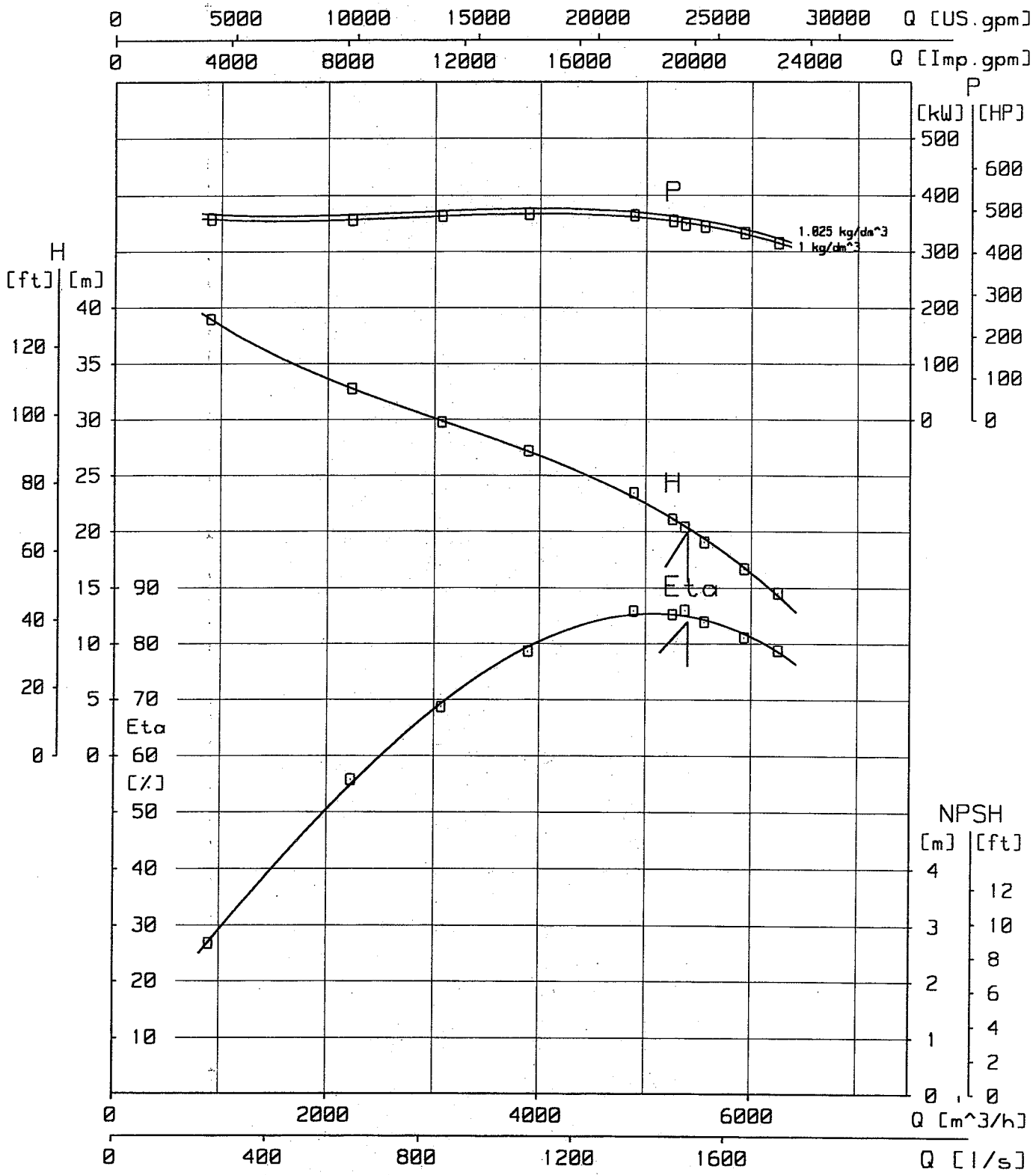
test leader: H. Müller
city: WITTEN-Annen

RUHRPUMPEN

TR 600/4/580

n= 890 1/min

AD-Nr. : 25839
Order-Nr. : 26-1822
Item-Nr. : CW-PP 301



Guarantee :	Q m^3/h	H m	Eta %	NPSH m	P kW	Visc. cSt
	5400	20	84			

D2i = 540 mm
D2a = 660 mm
D2m = 600 mm

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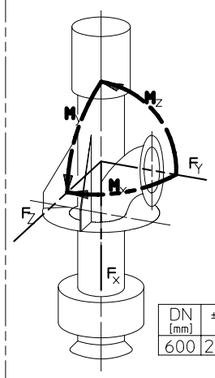
Date : 18.11.2005 Signature :

existing E - Motor
Type Ansaldo WV 400 Y 8
480 kW ; 4160 V ; 60 Hz
889 Min-1

FOUNDATION LOAD

PUMP	53.000 N
WATERFILLING	19.500 N
MOTOR	33.000 N
TOTAL(APPR.)	105.500 N



Die gesamte resultierende Kraft und das gesamte resultierende Moment darf fogenden Wert nicht überschreiten:

The complete resultant force and the resultant moment must not exceed the following figure:

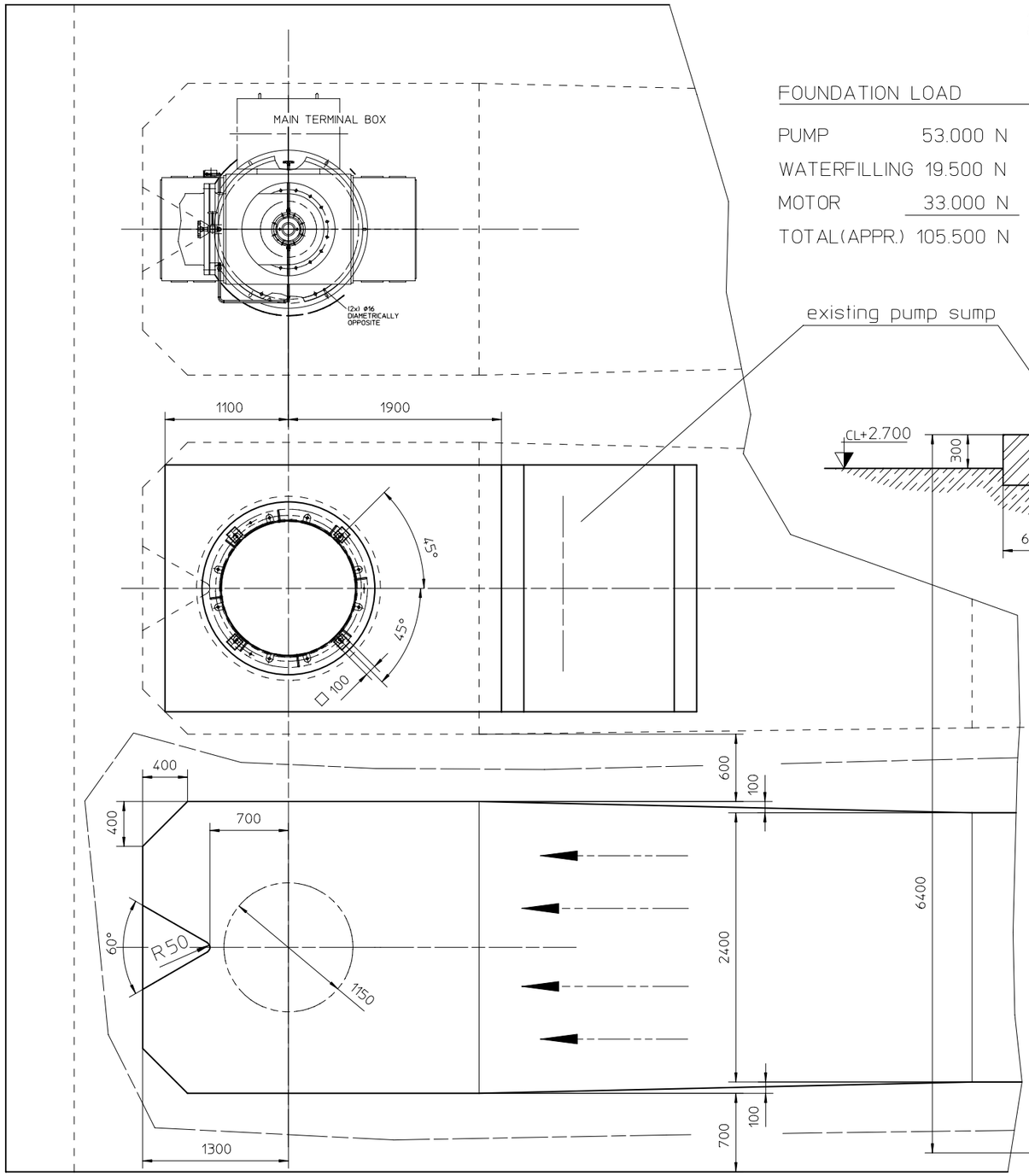
$$\frac{F}{[N]} + \frac{1.6M}{[Nm]} \leq K$$

F > resultierende Kraft in N
resultant forces in N
M > resultierendes Moment in Nm
resultant moment in Nm

Die Komponenten der resultierenden Kraft und des resultierenden Momentes dürfen die jeweiligen Maximalwerte (Fx,Fy,Fz,Mx,My,Mz) nicht überschreiten.

The components of the resultant force and the result moments must not exceed the relevant maximum figures (Fx,Fy,Fz,Mx,My,Mz).

DN [mm]	±Fx [N]	±Fy [N]	±Fz [N]	±Mx [Nm]	±My [Nm]	±Mz [Nm]	K -
600	22700	45500	31500	28000	14000	14000	45500



Building and foundations not verified statically and dynamically
Piping and accessories to be connected without stresses
Foundation holes filled up with concrete during erection

Maße in mm obligatory
Maße in mm verbindlich

Flanschanschlußmaße
flange dimensions 24" ASME B16.5 150lbs

Nennweite size	Flansch flange	Lochkreis boltcircle	Bohrung bolt hole	Anzahl No.of holes	Flanschdicke fl. thickness
600	Ø813	Ø749.3	Ø35	20	46

Customer : Doosan Engine Co. Ltd
Location : Changwon City Kyungnam Korea
Requisition No. : E0530039
Customer-Pos. No. : CW-PP 301

Ruhrpumpen Proj.No.: 26-1822

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TR 600/4/580

	Datum	Name
Bearb.	2005/06/02	blind
Gepr.	2005/06/02	blind
Freige	2005/06/02	blind
Status	2005/06/02	freigegeben

Benennung: Installation drawing

Änd.-Mittlg.-Nr. | Datum | Name | geprüft

RUHRPUMPEN

Zeichnungs-Nr. 7006130542.2 | Format 0 | Rev. | Blatt 1 - Blätter

Urspr. 7006130316.2 | Ers.für | Ers.durch

Ruhrpumpen GmbH
D - 58432
Postfach 6309
Germany

Spare parts

RUHRPUMPEN

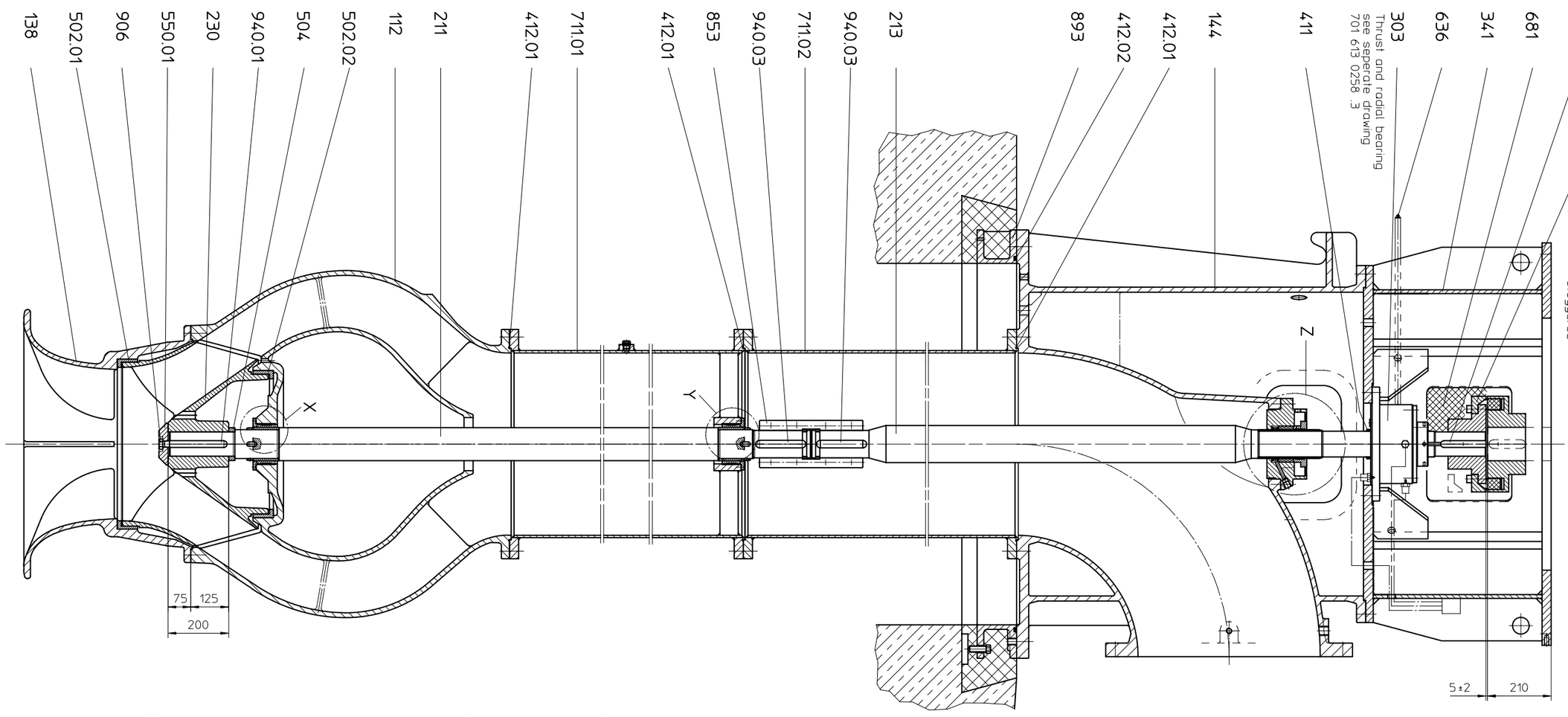
Order-No.		**261822**					
Customer-Pump-Nr.		**CW-PP 301**					
		Quantity	Assembly Drawing	Description		Type & Size	
	61219	1	7016130509.1 7016130258.3	Centrifugal Pump Thrust and radial bearing		TR 600/4/580	
Pos-No.	Ident-No.	Quantity	Drawing	Description	Standard	Size	Material
112	261822 191160098	1	7021120592 .2	Pump bowl			GX2CrNiMoN25-6-3 (1.4468) EN 10283
138	261822 191360128	1	7021380420 .3	Bellmouth			GX2CrNiMoN25-6-3 (1.4468) EN 10283
144	261822 191460092	1	7021440274 .1	Delivery elbow		DN600	GJSA-XNiCrNb20-2 /JS3031 (GGG-NiCrNb20 2) EN 13835
211	261822 192160235	1	7022112800 .3	Pump shaft		L=3743	X6CrNiMoTi17-12-2 (1.4571) EN 10088-3
213	261822 192160236	1	7022130558 .3	Top shaft		L=3222	X6CrNiMoTi17-12-2 (1.4571) EN 10088-3
230	261822 192360186	1	7022304174 .2	Impeller		660/540	GX6CrNiN26-7 (1.4347) EN 10283
303	261822 561015255	1	7016130258 .3	Thrust and radial bearing		F 80/1	
320	261822 610300302	1		Anti-friction bearing	DIN628	7221BM	
321	261822 610301073	1		Radial ball bearing	DIN625	6026M	
341	261822 193460095	1	7023410821 .1	Motor stool			weldment S235JRG2
350	261822 193560020	1	7023500511 .1	Bearing housing			GJL-250 (GG-25) EN 1561
360 .01	261822 193660129	2	7023600750 .4	Bearing cover		SIC 110	GX6CrNiN26-7 (1.4347) EN 10283
360 .02	261822 193660034	1	7023600640 .4	Bearing cover			C 45+N (1.0503) EN 10083
411	261822 610412350	1		Joint ring	RM00041	V-85S	NBR 70
412 .01	261822 194100002	3		Round section joint ring		630x4	NBR 70
412 .02	261822 194100006	1		Round section joint ring		1228x10	NBR 70
412 .03	261822 194100002-01	1		Round section joint ring		230x4	NBR 70
452	261822 194560149	1	7024520079 .4	Stuffing box gland			GJSA-XNiCrNb20-2 /JS3031 (GGG-NiCrNb20 2) EN 13835
455	261822 194560148	1	7024550324 .3	Stuffing box insert			GJSA-XNiCrNb20-2 /JS3031 (GGG-NiCrNb20 2) EN 13835
458	261822 194560150	1	7024580034 .4	Lantern ring		96/120/25	GX5CrNiMo19-11-2 (1.4408) EN 10283
461	261822 194600003	4		Gland packing	Merkel	96/120x12	Nr. 4586 Merkel Ramilon
500	261822 195060393	2	7025000278 .4	Ring		110	GX5CrNiMo19-11-2 (1.4408) EN 10283
502 .01	261822 195060395	1	7025020620 .4	Casing wear ring		505/560/67	GX40CrNi27-4 (1.4340) SEW 410
502 .02	261822 195060394	1	7025020093 .4	Casing wear ring		430/485/67	GX40CrNi27-4 (1.4340) SEW 410
504	261822 195060396	1	7025040080 .4	Spacer ring		80/108/30	GX5CrNiMo19-11-2 (1.4408) EN 10283
514	261822 195160009	1	7025140084 .3	Threaded ring		M85x2	C 45+N (1.0503) EN 10083
524 .01	261822 195260026	2	7025241277 .4	Shaft sleeve	SIC	110	Silicon carbide

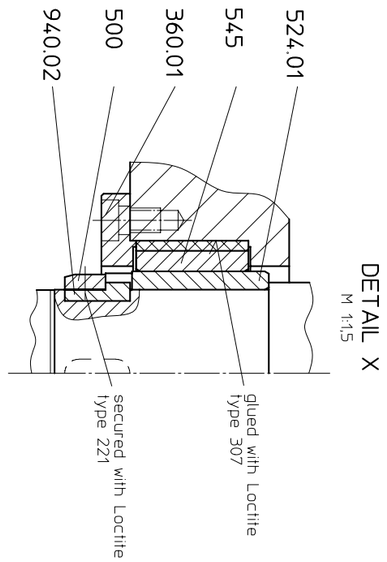
Ruhrpumpen GmbH
D - 58432
Postfach 6309
Germany

Spare parts

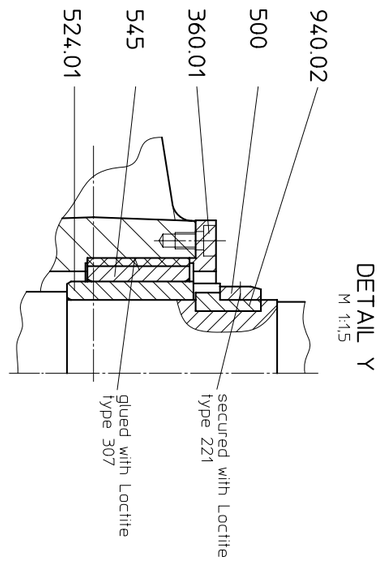
RUHRPUMPEN

Order-No.		**261822**					
Customer-Pump-Nr.		**CW-PP 301**					
		Quantity	Assembly Drawing	Description		Type & Size	
	61219	1	7016130509.1 7016130258.3	Centrifugal Pump Thrust and radial bearing		TR 600/4/580	
Pos-No.	Ident-No.	Quantity	Drawing	Description	Standard	Size	Material
524 .02	261822 195260282	1	7025241278 .4	Shaft sleeve	F 5.2		GX5CrNiMo19-11-2 / F 5.2 DIN 32529
526	261822 195260042	1	7025260220 .3	Centering sleeve		85/140/124	C 45+N (1.0503) EN 10083
545	261822 195460026	2	7025450583 .4	Bearing bush	SIC/NBR	110	Silicon carbide / NBR 70
550 .01	261822 195560097	1	7025500350 .4	Disc			X6CrNiMoTi17-12-2 (1.4571) EN 10088-3
550 .02	261822 195560018	1	7025500344 .4	Disc			C 45+N (1.0503) EN 10083
636	200003758	1		Grease nipple	DIN71412	AR1/4	CuZn
681	261822 196840062	2	7026810682 .4	Coupling guard		305/440	brass
711 .01	261822 197160182	1	7027110638 .2	Column pipe		DN600/LS110	weldment S235JRG2
711 .02	261822 197160183	1	7027110639 .3	Column pipe		DN600	weldment S235JRG2
840	261822 610800240	1		Coupling	Flender	N-EUPEX_A	
853	261822 561012767	1		Muff coupling, split	WN2217	90	
893	261822 198960013	1	7028930016 .3	Mounting plate		D1190	GJL-250 (GG-25) EN 1561
906	200013514	1	7071002037 .4	Impeller screw	ISO8676	M20x1,5x60	A4-70/Blau Kel-F (thermo tight)
940 .01	261822 199400033	1		Fitting key	DIN6885	B22x14x178	X17CrNi16-2+QT800+C (1.4057) EN 10088
940 .02	261822 199460001	2	7029400128 .4	Fitting key		A14x9x32SP.	X17CrNi16-2+QT800+C (1.4057) EN 10088
940 .03	261822 199400034	2		Fitting key	DIN6885	B25x14x140	X17CrNi16-2+QT800+C (1.4057) EN 10088
940 .04	261822 199400033-01	1		Fitting key	DIN6885	B22x14x139	X17CrNi16-2+QT800+C (1.4057) EN 10088
942	261822 610200419	1		Key	DIN6880	16x10x28	C 45+C (1.0503) EN 10083





DETAIL X
M 1:1.5



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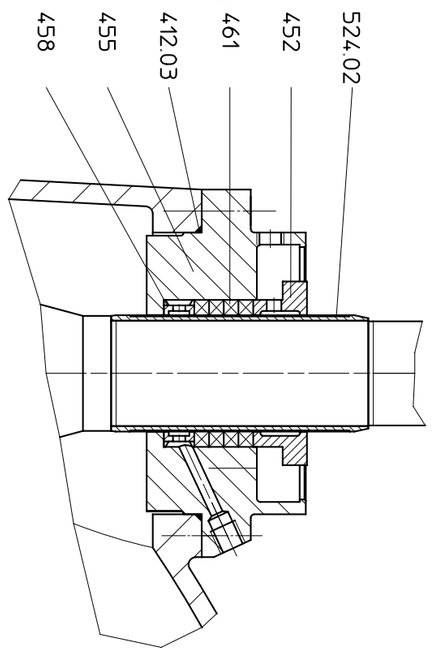
M 1:1.5



DETAIL Z
M 1:2.5

Customer	:	Doosan Engine Co. Ltd
Location	:	Changwon City Kyungnam Korea
Requisation No.	:	E0530039
Customer-Pos. No.	:	CW-PP 301
Ruhrpumpen Proj.No.	:	26-1822

Für diese Unterlage behalten wir uns alle Rechte vor. Ohne unsere vorherige Zustimmung darf diese Unterlage weder vervielfältigt noch Dritten zugänglich gemacht noch in anderer Weise verwertet werden. Zuwiderhandlungen verpflichten zu Schadenersatz und sind strafbar.

	Datum	Name
Bearb.	2005/06/01	blind
Gepr.	2005/11/25	blind
Freige	2005/11/25	blind
Status	2005/11/25	freigegeben

TR 600/4/580

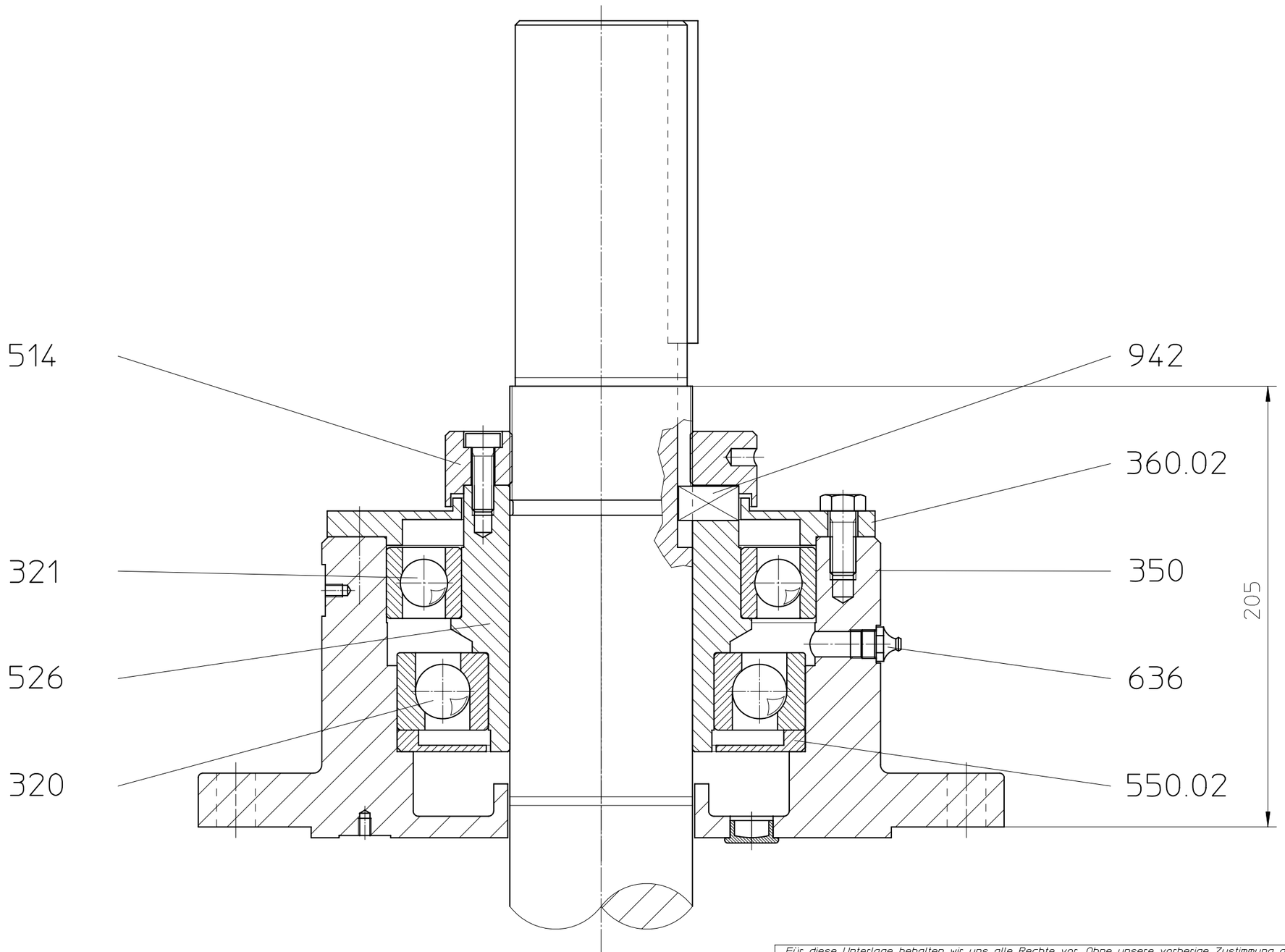
Benennung: Sectional Drawing

RUHRPUMPEN

Zeichnungs-Nr.: 7016130509.1 | Format: | Rev.: 0 | Blatt: 1 - Blätter

And.-Mitlg.-Nr.: | Datum | Name | geprüft

Urspr.: 7016130257.1 | Ers.für: | Ers.durch:



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F 80/1

	Datum	Name
Bearb.	25.Feb.94	Drees
Gepr.	4.May.94	schwarz .
Norm		
Status	T200W	freigegeben

Benennung CAD - erstellt

Trag-u.Führungslager
thrust and radial bearing
fettgeschmiert

RUHRPUMPEN

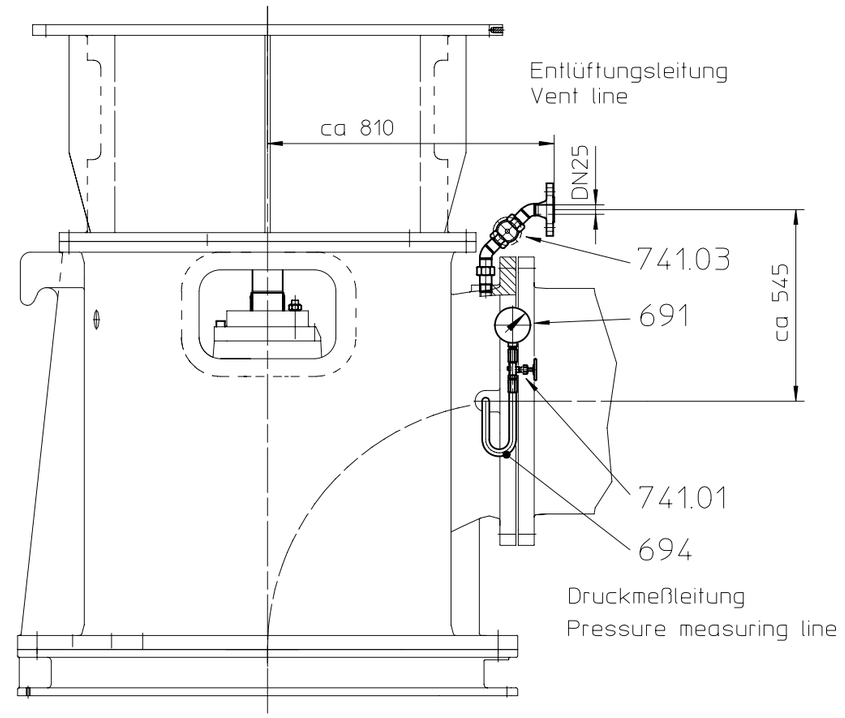
Zeichnungs-Nr. 701 613 0258 03

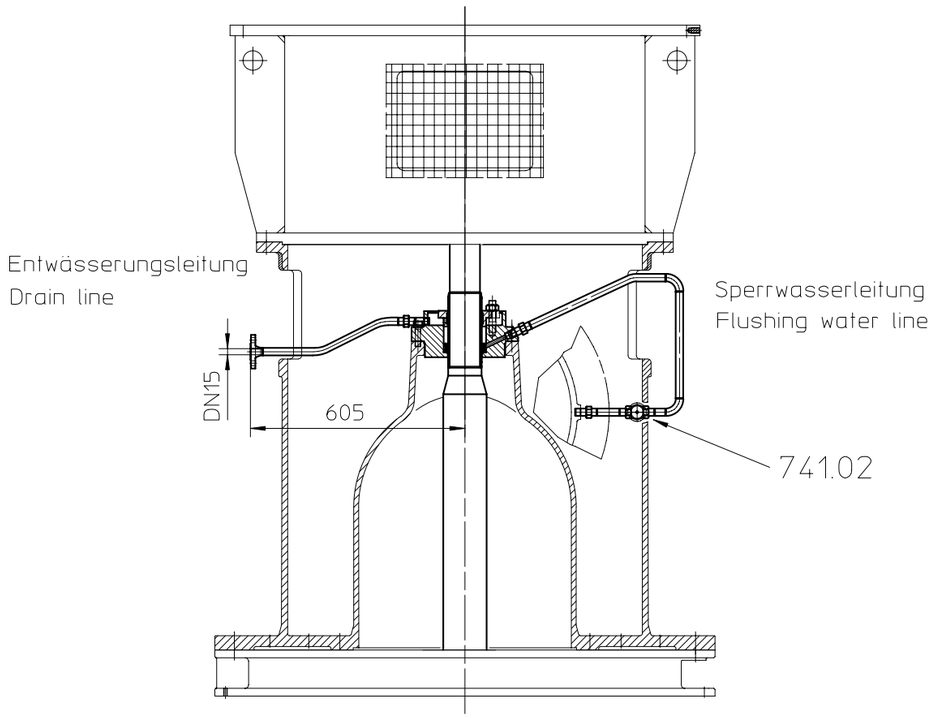
Blatt

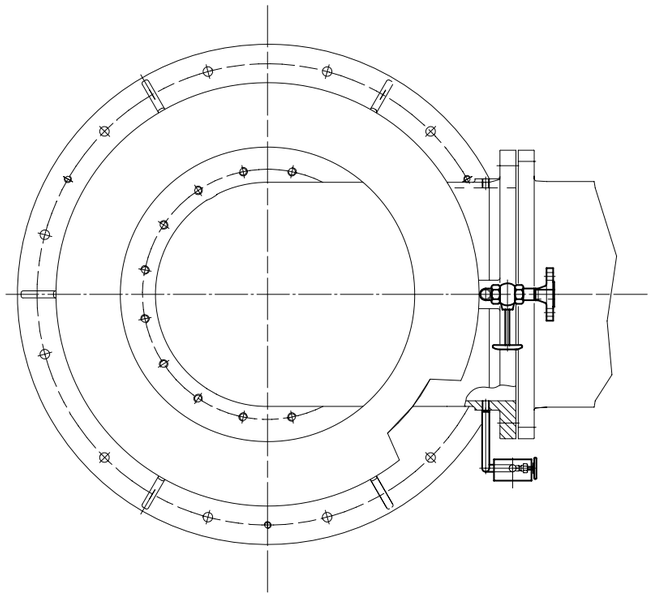
Blätter

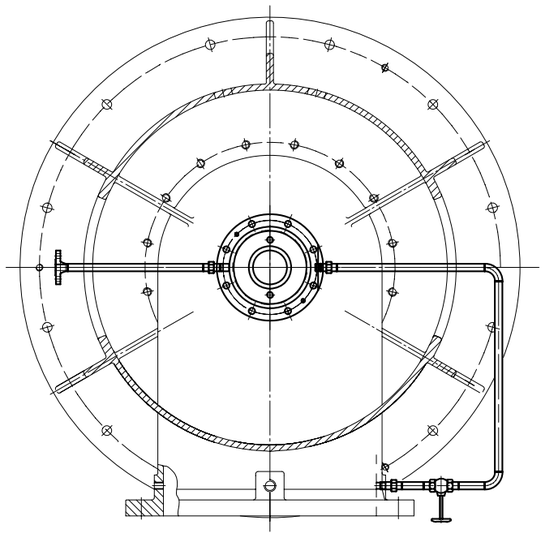
Änd.-Buchst. kommt vor	Änd.-Mittlg.-Nr.	Datum	Name
		geprüft	

Urspr. 701 613 0057 03 Ers.für Ers.durch









Für diese Unterlage behalten wir uns alle Rechte vor. Ohne unsere vorherige Zustimmung darf diese Unterlage weder vervielfältigt noch Dritten zugänglich gemacht noch in anderer Weise verwertet werden. Zuwiderhandlungen verpflichten zu Schadenersatz und sind strafbar.

TR 600/4/580

	Datum	Name
Bearb.	9 Jun.94	Schwarz
Gepr.	9 Jun.94	Schwarz
Norm		
Status	T200W	freigegeben

Benennung: CAD - erstellt

Rohrleitungsplan
Piping

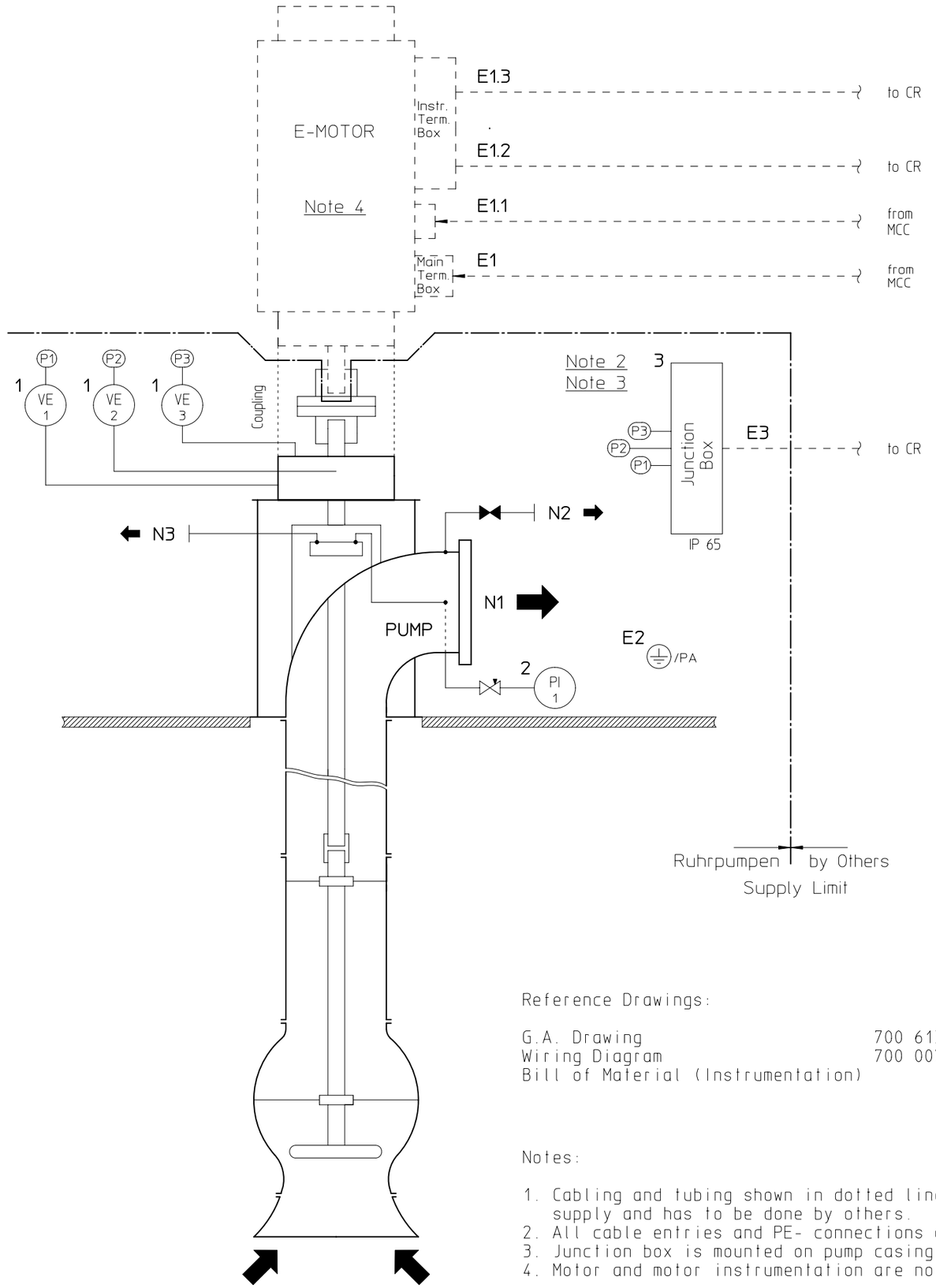
RUHRPUMPEN

Zeichnungs-Nr.: 701 613 0270 02

Blatt 1 Blätter

Änd.-Buchst. Kontr. | Änd.-Mitlg.-Nr. | Datum | Name | geprüft

Urspr. | Ers.für | Ers.durch



Symbol Legend		
normally open	closed	
		Gate Valve
		Ball Valve
		Globe Valve
		Needle Valve
		Instrument Valve
		Block & Bleed Valve
		Overload Protector
		Check Valve
		Strainer
		Flange

Instrument Description

Id. Ref.	TAG No.	Remarks
1	VE-1	Vibration Element, Bear. Housing X-Position
	VE-2	Vibration Element, Bear. Housing Y-Position
	VE-3	Vibration Element, Bear. Housing Z-Position
2	PI-1	Pressure Indicator, Pump Discharge Line
3		Junction Box, Pump Vibration Signals

Terminal Points

Id. Ref.	Connections	
E 1	Motor Main Terminal Box Conn.	Note 4
E 1.1	Motor Space Heater Box Conn.	Note 4
E 1.2	Motor Aux. Terminal Box Conn. Bearing RTD´s	Note 4
E 1.3	Motor Aux. Terminal Box Conn. Winding RTD´s	Note 4
E 2	Unit Earthing Conn.	1x M12
E 3	Junction Box Conn. Pump Vibration Signals	M20x 1,5

Terminal Points

Id. Ref.	Connections	
N 1	Pump Discharge Flange	24" ASME-B16.5-150lbs-FF
N 2	Pump Vent Line Flange	1" ANSI-B16.5-150lbs-RF
N 3	Pump Drain Line Flange	1/2" ANSI-B16.5-150lbs-RF

Site Data:

Location: outdoor
Ambient temperature: 5 to 40°C
Ex. area classification: safe area

CUSTOMER: DOOSAN ENGINE Co. LTD

PLANT SITE: Cabras No. 3&4 Diesel Power Plant, Guam, USA

ITEM NO: CW-PP 301

RP PROJECT NO.: 261822

Reference Drawings:

G.A. Drawing	700 613 0542 .2
Wiring Diagram	700 007 1279 .2
Bill of Material (Instrumentation)	

Notes:

1. Cabling and tubing shown in dotted lines is not Ruhrpumpen supply and has to be done by others.
2. All cable entries and PE- connections are from bottom side.
3. Junction box is mounted on pump casing.
4. Motor and motor instrumentation are not Ruhrpumpen supply.

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TR 600/4/580		Datum	Name
	Bearb.	2005/06/01	burzan
	Gepr.	2005/08/01	Bruns
	Freige.	2005/08/01	Bruns
	Status	2005/08/01	freigegeben

Benennung: P-I Diagram

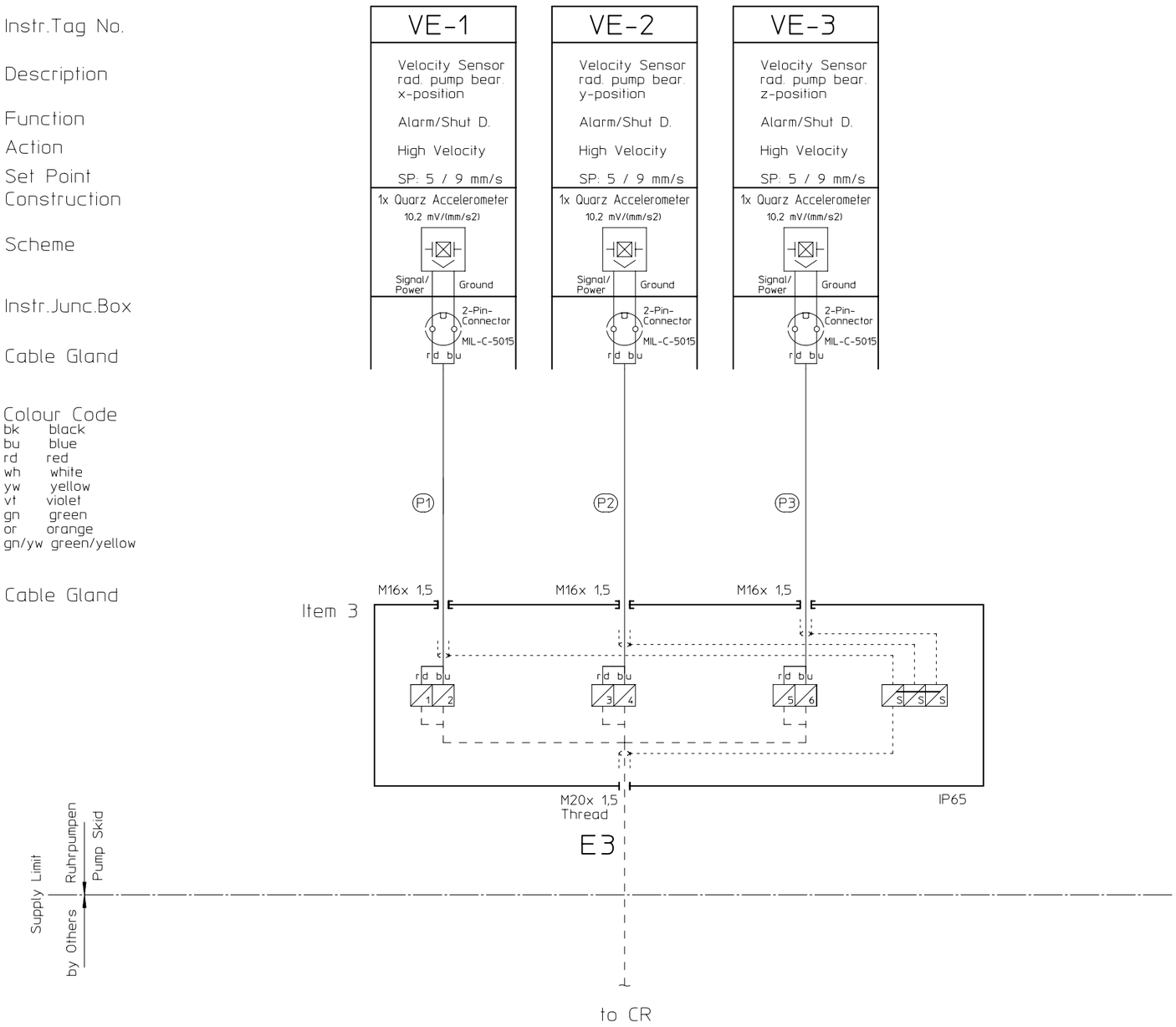
RUHRPUMPEN

Zeichnungs-Nr.: 7000031020 . 2 | Format | Rev.: 0 | Blatt: 1 - Blätter

Änd.-Mittlg.-Nr. | Datum | Name: geprüft

Urspr. | Ers.für | Ers.durch

Item	1	1	1
Protection Mode	IP68	IP68	IP68
Mfr.& Model No.	Synotech PCB-M627A01	Synotech PCB-M627A01	Synotech PCB-M627A01
Instr.Tag No.	VE-1	VE-2	VE-3
Description	Velocity Sensor rad. pump bear. x-position	Velocity Sensor rad. pump bear. y-position	Velocity Sensor rad. pump bear. z-position
Function	Alarm/Shut D.	Alarm/Shut D.	Alarm/Shut D.
Action	High Velocity	High Velocity	High Velocity
Set Point	SP: 5 / 9 mm/s	SP: 5 / 9 mm/s	SP: 5 / 9 mm/s
Construction	1x Quarz Accelerometer 10,2 mV/(mm/s2)	1x Quarz Accelerometer 10,2 mV/(mm/s2)	1x Quarz Accelerometer 10,2 mV/(mm/s2)
Scheme	Signal/Power, Ground, 2-Pin-Connector MIL-C-5015, rd bu	Signal/Power, Ground, 2-Pin-Connector MIL-C-5015, rd bu	Signal/Power, Ground, 2-Pin-Connector MIL-C-5015, rd bu
Instr.Junc.Box	P1	P2	P3
Cable Gland	M16x 1,5	M16x 1,5	M16x 1,5



Note 5

Colour Code
bk black
bu blue
rd red
wh white
yw yellow
vt violet
gn green
or orange
gn/yw green/yellow

Site Data:

Location: outdoor
Ambient temperature: 5 to 40°C
Ex. area classification: safe area

Reference Drawings:

G.A. Drawing 700 613 0542 .2
P&I Diagram 700 003 1020 .2
Bill of Material (Instrumentation)

Cable List:

(P1) - (P3) Synotech M052AE003AD
3 m general purpose, polyurethane jacketed, shielded, twisted pair (rd, bu) cable with two-pin socket MIL type MS3106 and environmental boot.
Outer diamater: 6,4 mm

CUSTOMER: DOOSAN ENGINE Co. LTD

PLANT SITE: Cabras No. 3&4 Diesel Power Plant, Guam, USA

ITEM NO: CW-PP 301

RP PROJECT NO.: 261822

Notes:

1. Cabling and tubing shown in dotted lines is not Ruhrpumpen supply and has to be done by others.
2. All cable entries and PE- connections are from bottom side.
3. Junction box is mounted on pump casing.
4. Motor and motor instrumentation are not Ruhrpumpen supply.
5. Acceleration signals of sensors have to be transformed into velocity signals by customers control unit.

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TR 600/4/580

	Datum	Name
Bearb.	2005/06/02	burzan
Gepr.	2005/08/01	Bruns
Freige	2005/08/01	Bruns
Status	2005/08/01	freigegeben

Benennung: Wiring Diagram

Änd.-Mittlg.-Nr. | Datum | Name | geprüft

RUHRPUMPEN

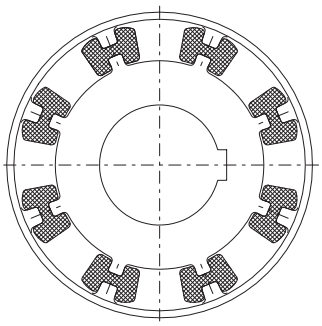
Ursprung | Ersatz für | Ersatz durch

Zeichnungs-Nr. 7000071279.2 | Format | Rev. 0 | Blatt 1 - Blätter

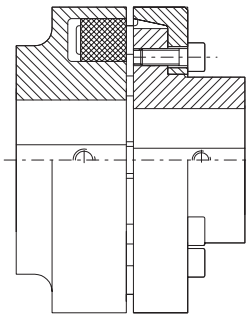
Operating Instructions

BA 3100 EN 07.03

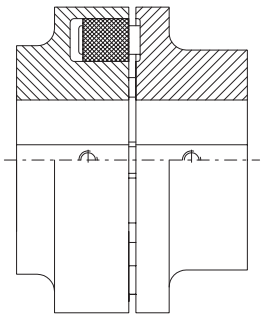
Flexible **N-EUPEX** and **N-EUPEX-DS** couplings
Types **A, B** and **ADS, BDS**



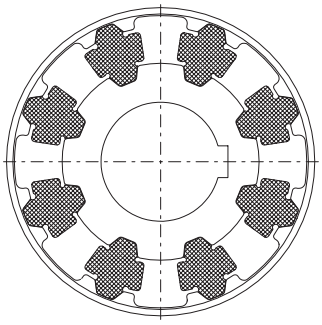
N-EUPEX



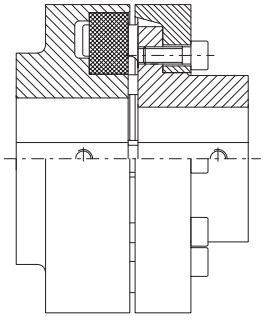
A



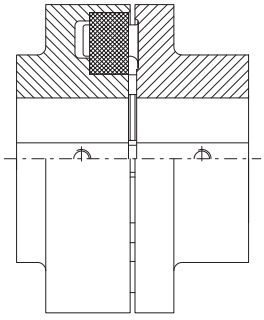
B



N-EUPEX-DS



ADS



BDS

FLENDER

A. Friedr. Flender AG · 46393 Bocholt · Tel. 02871/92-0 · Telefax 02871/92-2596 · www.flender.com

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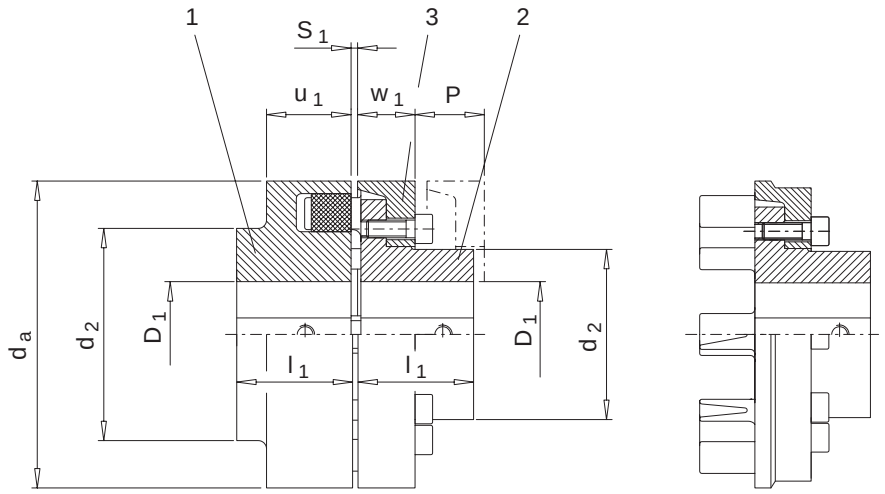
1. Technical data

1.1 N-EUPEX coupling, Types A and B

1.1.1 Geometric data

Type A



Sizes 110 to 350

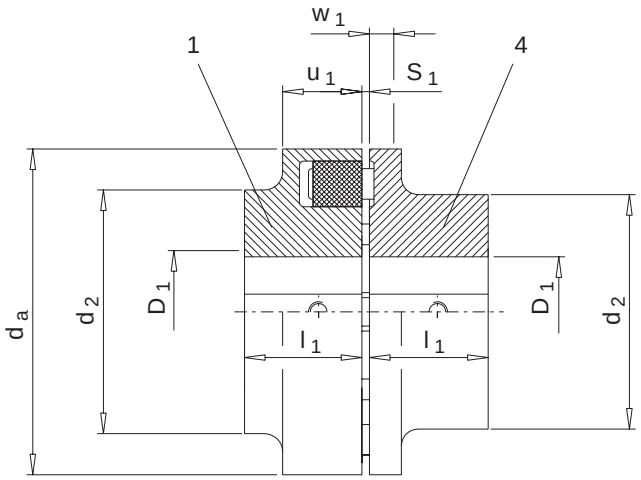
Sizes 400 to 710

Size	Bore D_1 Part 1 from mm	Part 1 to mm	Part 2 from mm	Part 2 to mm	d_a mm	d_2 Part 1 mm	d_2 Part 2 mm	w_1 mm	l_1 mm	u_1 mm	P mm	S_1 mm	Weight 1) Part 1 kg	Weight 1) Part 2+3 kg	Mass moment of inertia 1) Part 1 kgm^2	Mass moment of inertia 1) Part 2+3 kgm^2
110		48		38	110	86	62	20	40	34	33	2.... 4	1.9	1.6	0.0027	0.002
125		55		45	125	100	75	23	50	36	38	2.... 4	2.9	2.7	0.005	0.0045
140		60		50	140	100	82	28	55	34	43	2.... 4	3.3	3.7	0.007	0.008
160		65		58	160	108	95	28	60	39	47	2.... 6	4.7	5.1	0.013	0.015
180		75		65	180	125	108	30	70	42	50	2.... 6	6.9	7.3	0.023	0.026
200		85		75	200	140	122	32	80	47	53	2.... 6	9.5	10.3	0.04	0.045
225		90		85	225	150	138	38	90	52	61	2.... 6	13	14	0.07	0.08
250	46	100	32	95	250	165	155	42	100	60	69	3.... 8	17.5	19.5	0.12	0.13
280	49	110	54	105	280	180	172	42	110	65	73	3.... 8	24	24	0.2	0.2
315	49 90	100 120	46 90	100 120	315	165 200	165 200	47	125	70	78	3.... 8	31 32	32 34	0.31 0.34	0.33 0.37
350	61 90	110 140	61 90	110 140	350	180 230	180 230	51	140	74	83	3.... 8	43 45	43 47	0.54 0.60	0.54 0.63
400	66 100	120 150	66 100	120 150	400	200 250	200 250	56	160	78	88	3.... 8	63 66	59 64	1 1.2	0.9 1
440	80 120	130 160	80 120	130 160	440	215 265	215 265	64	180	86	99	5...10	79 82	80 85	1.5 1.7	1.5 1.7
480	90 136	145 180	90 136	145 180	480	240 300	240 300	65	190	90	104	5...10	100 105	100 110	2.3 2.6	2.3 2.6
520	100 140	150 190	100 140	150 190	520	250 315	250 315	68	210	102	115	5...10	130 140	120 135	3.5 3.8	3.2 3.6
560	120	200	120	200	560	320	320	80	220	115	125	6...12	180	185	5.9	6
610	130	220	130	220	610	352	352	88	240	121	135	6...12	225	240	8.6	9.3
660	140	240	140	240	660	384	384	96	260	132	145	6...12	290	320	13	14
710	140	260	140	260	710	416	416	102	290	138	155	6...12	370	400	18.5	20

Table 1.1.1 a : Dimensions, weights and mass moments of inertia of Type A

1) Weights and mass moments of inertia apply to mean bores

Type B



Size	Bore D_1				d_a	d_2		w_1	l_1	u_1	S_1	Weight 1)		Mass moment of inertia 1)	
	Part 1		Part 4			Part						Part		Part	
	from	to	from	to		1	4					1	4	1	4
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg	kgm^2	kgm^2
58		19		24	58	–	40	8	20	20	2...4	0.22	0.23	0.0001	0.0001
68		24		28	68	–	50	8	20	20	2...4	0.31	0.32	0.0002	0.0001
80		30		38	80	–	68	10	30	30	2...4	0.79	0.72	0.0006	0.0006
95		42		42	95	76	76	12	35	30	2...4	1.2	1.4	0.0013	0.0014
110		48		48	110	86	86	14	40	34	2...4	1.9	2.0	0.0027	0.0028
125		55		55	125	100	100	18	50	36	2...4	2.9	3.3	0.005	0.0057
140		60		60	140	100	100	20	55	34	2...4	3.3	3.6	0.007	0.007
160		65		65	160	108	108	20	60	39	2...6	4.7	4.7	0.013	0.012
180		75		75	180	125	125	20	70	42	2...6	6.9	7.1	0.023	0.022
200		85		85	200	140	140	24	80	47	2...6	9.5	10.5	0.04	0.04
225		90		90	225	150	150	18	90	52	2...6	11.5	13	0.07	0.065
250	46	100	46	100	250	165	165	18	100	60	3...8	17.5	16.5	0.12	0.11
280	49	110	54	110	280	180	180	20	110	65	3...8	24	21	0.2	0.17

Table 1.1.1 b : Dimensions, weights and mass moments of inertia of Type B

1) Weights and mass moments of inertia apply to mean bores

1.1.2 Performance data

Note: For identification marking of the individual flexible elements, refer to section 5.

Flexible elements: 80 Shore A									
Size	Rated torque	Maximum torque	Fatigue torque	Speed	dynamic torsional stiffness $C_{T\,dyn}$				
	T_{KN}	T_{Kmax}	T_{KW}	n_{max}	$1xT_{KN}$	$0.75xT_{KN}$	$0.5xT_{KN}$	$0.25xT_{KN}$	$0xT_{KN}$
	Nm	Nm	Nm	1/min	Nm/rad	Nm/rad	Nm/rad	Nm/rad	Nm/rad
58	19	57	7.6	5000	1200	850	600	430	300
68	34	102	13.6	5000	1300	930	670	480	350
80	60	180	24	5000	2750	1950	1400	980	700
95	100	300	40	5000	4200	3100	2300	1700	1280
110	160	480	64	5000	5700	4200	3100	2250	1670
125	240	720	96	5000	16000	10000	6200	3800	2400
140	360	1080	144	4900	24000	15000	9600	6200	4000
160	560	1680	224	4250	49000	34000	23000	16000	11000
180	880	2640	352	3800	78000	51000	33000	21500	14000
200	1340	4020	536	3400	127000	80000	51000	32000	20500
225	2000	6000	800	3000	210000	136000	87000	56000	36000
250	2800	8400	1120	2750	290000	176000	107000	65000	40000
280	3900	11700	1560	2450	365000	233000	149000	94000	60000
315	5500	16500	2200	2150	840000	540000	340000	215000	138000
350	7700	23100	3080	1950	920000	590000	380000	245000	160000
400	10300	30900	4120	1700	1350000	840000	530000	335000	210000
440	13500	40500	5400	1550	1830000	1180000	760000	490000	315000
480	16600	49800	6640	1400	2000000	1300000	830000	530000	340000
520	21200	63600	8480	1300	2700000	1770000	1150000	740000	480000
560	29000	87000	11600	1200	3600000	2300000	1500000	960000	620000
610	38000	114000	15200	1100	5000000	3200000	2070000	1330000	850000
660	49000	147000	19600	1000	6800000	4350000	2800000	1800000	1150000
710	62000	186000	24800	950	9300000	6000000	3900000	2500000	1600000

damping coefficient Ψ = 1.1

Flexible elements: 60 Shore A									
Size	Rated torque	Maximum torque	Fatigue torque	Speed	dynamic torsional stiffness $C_{T\,dyn}$				
	T_{KN}	T_{Kmax}	T_{KW}	n_{max}	$1xT_{KN}$	$0.75xT_{KN}$	$0.5xT_{KN}$	$0.25xT_{KN}$	$0xT_{KN}$
	Nm	Nm	Nm	1/min	Nm/rad	Nm/rad	Nm/rad	Nm/rad	Nm/rad
58	11	35	4	5000	360	290	235	190	150
68	21	64	8	5000	400	325	260	210	175
80	37	113	15	5000	830	670	540	430	350
95	63	190	25	5000	1340	1110	920	760	640
110	100	300	40	5000	1800	1500	1200	1000	830
125	150	450	60	5000	4000	3000	2150	1600	1200
140	230	680	90	4900	6000	4600	3500	2600	2000
160	350	1060	140	4250	14000	11000	8800	7000	5500
180	550	1660	220	3800	20700	15700	12000	9200	7000
200	850	2530	337	3400	32200	24300	18000	13400	10200
225	1260	3780	504	3000	55000	41400	31500	24000	18000
250	1760	5300	705	2750	69000	50600	37000	27000	20000
280	2460	7400	980	2450	94000	71000	53000	39500	30000
315	3500	10500	1400	2150	216500	161500	121000	91000	69000
350	4850	14500	1940	1950	239000	181000	137000	104000	80000
400	6500	19500	2600	1700	336000	252000	189000	141000	105000
440	8500	25500	3400	1550	478000	362000	275000	208000	158000
480	10500	31400	4200	1400	525000	395000	298000	225000	170000
520	13300	40000	5300	1300	720000	548000	415000	314000	240000
560	18300	54800	7300	1200	936000	715000	541000	404000	310000
610	24000	71800	9600	1100	1297000	987000	747000	562000	425000
660	30900	92600	12350	1000	1759000	1334000	1010000	763000	575000
710	39000	117000	15600	950	2440000	1860000	1400000	1050000	800000

damping coefficient Ψ = 1.1

The performance data for Types A and B are valid for:

- max. 25 starts per hour
- daily operating cycle of up to 24 h
- operation within the specified alignment
- Operation in the temperature range -30 °C to +80 °C in the immediate vicinity of the coupling

Caution!

For sustained faultfree operation the coupling must be designed with a service factor f_1 in accordance with item 1.3 and appropriate to the application. In the event of a change in operating conditions (e.g. output, speed, starting frequency, changes to the prime mover and driven machine) the design must always be checked (see item 1.1.3).

1.1.3 Checking the selected coupling size

The following must apply to the coupling:

$T_{KN} \geq T_N \times f_1$

T_{KN} = rated coupling torque
T_N = rated system torque - rated drive torque acting on the coupling
f_1 = service factor in accordance with item 1.3

During starting or operation torque impulses up to 25 times per hour are permissible. The following applies:

$T_{Kmax} \geq T_{max}$

T_{Kmax} = maximum coupling torque
T_{max} = maximum system torque - peak drive torque acting on the coupling

The following must apply to the alternating torques occurring during operation:

$T_{KW} \geq T_W \times S_f \times f_1$

T_{KW} = fatigue torque load on the coupling
T_W = alternating torque load on the coupling
f_1 = service factor in accordance with item 1.3

$S_f = \sqrt{\frac{f_{Err}}{10Hz}}$ for $f_{Err} > 10$ Hz

$S_f = 1.0$ for $f_{Err} \leq 10$ Hz

f_{Err} = excitation frequency of the alternating torque load in Hz

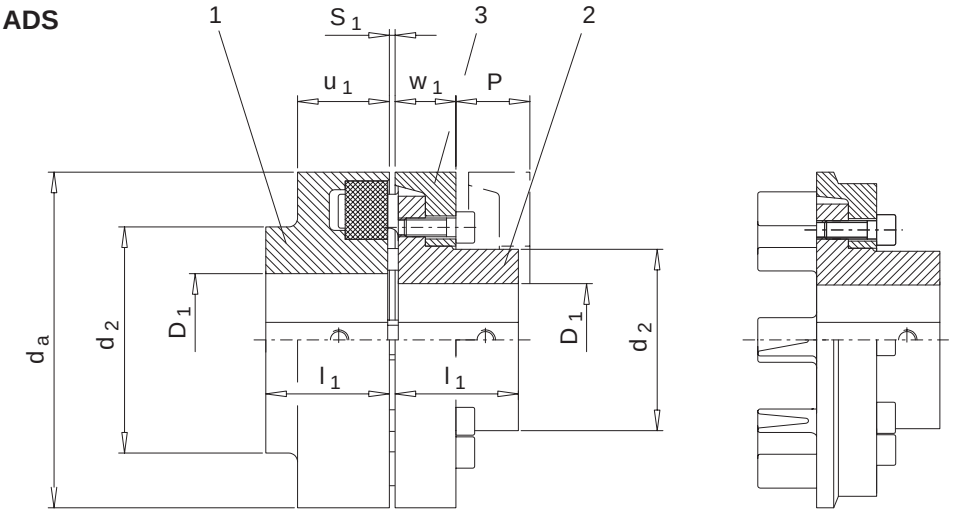
Caution! **When selecting the coupling, the permissible maximum speed and the permissible maximum bore must also be taken into consideration. Selection of bore fit in accordance with section 6. item 6.1.1.**

Caution! **The shaft displacement values specified in section 6, item 6.5.4, must not be exceeded.**

1.2 N-EUPEX-DS coupling, Types ADS and BDS

1.2.1 Geometric data

Type ADS



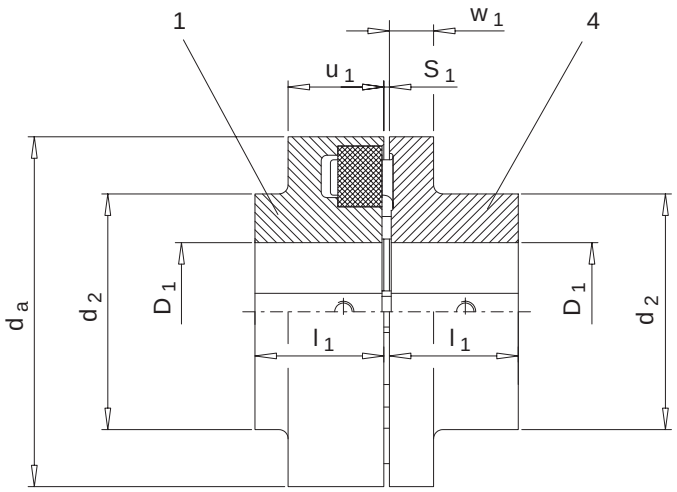
Sizes 118 to 380 Sizes 430 to 556

Size	Bore D_1				d_a	d_2		w_1	l_1	u_1	P	S_1	Weight 1) Part		Mass moment of inertia 1) Part	
	Part 1		Part 2			Part							1	2+3	1	2+3
	from	to	from	to		1	2									
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg	kgm^2	kgm^2
118		48		38	118	86	62	20	40	34	33	2.... 4	1.9	1.94	0.003	0.003
135		55		45	135	100	75	23	50	36	38	2.... 4	3.1	3.1	0.006	0.006
152		60		50	152	108	82	28	55	36	43	2.... 4	4.2	4.5	0.011	0.012
172		65		58	172	118	95	28	60	41	47	2.... 6	5.8	6	0.019	0.020
194		75		65	194	135	108	30	70	44	50	2.... 6	8.8	8.5	0.037	0.035
218		85		75	218	150	122	32	80	47	53	2.... 6	12	12	0.062	0.062
245		90		85	245	150	138	38	90	52	61	2.... 6	14.5	17.7	0.09	0.115
272	46	100	32	95	272	165	155	42	100	60	69	3.... 8	20	24.7	0.16	0.2
305	49	110	54	105	305	180	172	42	110	65	73	3.... 8	27	29.1	0.26	0.3
340	49	120	46 90	100 120	340	200	165 200	47	125	70	78	3.... 8	38	39.3 40.3	0.41 0.44	0.49 0.53
380	61	140	61 90	110 140	380	230	180 230	51	140	74	83	3.... 8	54	53.5 57.5	0.71 0.77	0.84 0.93
430	66	150	66 100	120 150	430	250	200 250	56	160	78	88	3.... 8	76	69 74	1.2 1.4	1.26 1.4
472	80	160	80 120	130 160	472	265	215 265	64	180	86	99	5...10	95	91 97	1.9 2.1	2 2.1
514	90	180	90 136	145 180	514	300	240 300	65	190	90	104	5...10	119	115 122	2.8 3.1	3 3.3
556	100	190	100 140	150 190	556	315	250 315	68	210	102	115	5...10	159	138 152	4.4 4.7	4.1 4.6

Table 1.2.1 a : Dimensions, weights and mass moments of inertia of Type ADS

1) Weights and mass moments of inertia apply to mean bores

Type BDS



Size	Bore D_1				d_a	d_2		w_1	l_1	u_1	S_1	Weight 1)		Mass moment of inertia 1)	
	Part 1		Part 4			Part						Part		Part	
	from	to	from	to		1	4					1	4	1	4
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg	kgm^2	kgm^2
66		19		24	66		40	8	20	20	2.... 4	0.24	0.31	0.0001	0.0002
76		24		28	76		50	8	20	20	2.... 4	0.33	0.42	0.0002	0.0003
88		30		38	88		68	10	30	30	2.... 4	1	0.92	0.0007	0.0006
103		42		42	103	76	76	12	35	30	2.... 4	1.6	1.5	0.0015	0.0014
118		48		48	118	86	86	14	40	34	2.... 4	1.9	2.1	0.003	0.0031
135		55		55	135	100	100	18	50	36	2.... 4	3.1	3.5	0.006	0.007
152		60		60	152	108	100	20	55	36	2.... 4	4.2	4.4	0.011	0.011
172		65		65	172	118	108	20	60	41	2.... 6	5.8	5.7	0.019	0.018
194		75		75	194	135	125	20	70	44	2.... 6	8.8	8.2	0.037	0.032
218		85		85	218	150	140	24	80	47	2.... 6	12	12.1	0.062	0.059
245		90		90	245	150	150	18	90	52	2.... 6	14.5	14.6	0.09	0.082
272	46	100	46	100	272	165	165	18	100	60	3.... 8	20	19.1	0.16	0.132
305	49	110	54	110	305	180	180	20	110	65	3.... 8	27	24.3	0.26	0.208

Table 1.2.1 b : Dimensions, weights and mass moments of inertia of Type BDS

1) Weights and mass moments of inertia apply to mean bores

1.2.2 Performance data

Size	Rated torque T_{KN} Nm	Maximum torque T_{Kmax} Nm	Fatigue torque T_{KW} Nm	Speed n_{max} 1/min	dynamic torsional stiffness $C_{T\,dyn}$ 1) Nm/rad
66	19	57	7.6	5000	–
76	34	102	13.6	5000	–
88	60	180	24	5000	5600
103	100	300	40	5000	9350
118	160	480	64	5000	15000
135	240	720	96	5000	22450
152	360	1080	144	4900	33650
172	560	1680	224	4250	52350
194	880	2640	352	3800	82250
218	1340	4020	536	3400	125250
245	2000	6000	800	3000	187000
272	2800	8400	1120	2750	114000
305	3900	11700	1560	2450	165000
340	5500	16500	2200	2150	239000
380	7700	23100	3080	1950	340000
430	10300	30900	4120	1700	460000
472	13500	40500	5400	1550	607000
514	16600	49800	6640	1400	750000
556	21200	63600	8480	1300	961000

damping coefficient Ψ = 1.1

1) The dynamic torsional stiffness applies at an ambient temperature of -30 °C to +40 °C

The performance data for the Types ADS and BDS are valid for:

- max. 25 starts per hour
- daily operating cycle of up to 24 h
- operation within the specified alignment
- Operation in the temperature range -30 °C to +80 °C in the immediate vicinity of the coupling

Caution!

For sustained faultfree operation the coupling must be designed with a service factor f_1 in accordance with item 1.3 and a temperature factor S_ϑ appropriate to the application. In the event of a change in operating conditions (e.g. output, speed, starting frequency, changes to the prime mover and driven machine) the design must always be checked (see item 1.2.3).

1.2.3 Checking the selected coupling size

The following must apply to the coupling:

$T_{KN} \geq T_N \times f_1 \times S_\vartheta$

T_{KN} = rated coupling torque
T_N = rated system torque - rated drive torque acting on the coupling
f_1 = service factor in accordance with item 1.3
S_ϑ = temperature factor

The highest temperature in the immediate vicinity of the coupling must be applied

T_U	from -30 °C to +40 °C	from +40 °C to +60 °C	from +60 °C to +80 °C
S_ϑ	1	1.4	1.8

Table 1.2.3: Temperature factor S_ϑ

During starting or operation torque impulses up to 25 times per hour are permissible. The following applies:

$T_{Kmax} \geq T_{max} \times S_\vartheta$

T_{Kmax} = maximum coupling torque
T_{max} = maximum system torque - peak drive torque acting on the coupling
S_ϑ = temperature factor

The following must apply to the alternating torques occurring during operation:

$T_{KW} \geq T_W \times S_f \times S_\vartheta \times f_1$

T_{KW} = fatigue torque load on the coupling
T_W = alternating torque load on the coupling
S_ϑ = temperature factor
f_1 = service factor in accordance with item 1.3

$S_f = \sqrt{\frac{f_{Err}}{10Hz}}$ for $f_{Err} > 10$ Hz

$S_f = 1.0$ for $f_{Err} \leq 10$ Hz

f_{Err} = excitation frequency of the alternating torque load in Hz

Caution! **When selecting the coupling, the permissible maximum speed and the permissible maximum bore must also be taken into consideration. Selection of bore fit in accordance with section 6. item 6.1.1.**

Caution! **The shaft displacement values specified in section 6, item 6.5.4, must not be exceeded.**

1.3 Determining the service factor

The service factors taken as basis are based on empirical values which generally estimate the output of in- and output combinations in service.

Service factor f_1 (daily operating cycle of up to 24 h)

Prime mover	Load characteristic of driven machine		
	G	M	S
Electric motors, Turbines, Hydraulic motors	1	1.25	1.75
Piston engines 4 - 6 cylinders Coefficient of cyclic variation up to 1 : 100 to 1 : 200	1.25	1.5	2
Piston engines 1 - 3 cylinders Coefficient of cyclic variation up to 1 : 100	1.5	2	2.5

Load characteristics of driven machines listed by area of application

Dredgers
- S Bucket-chain conveyors
- S Travelling gear (caterpillar)
- M Travelling gear (rails)
- M Manoeuvring winches
- M Lift pumps
- S Bucket wheels
- S Cutter heads
- M Slewing gear

Building machinery
- M Hoists
- M Concrete mixers
- M Road construction machinery

Chemical industry
- M Cooling drums
- M Mixers
- G Agitators (light liquids)
- M Agitators (semi-liquid material)
- M Drying drums
- G Centrifuges (light)
- M Centrifuges (heavy)

Mineral oil extraction
- M Pipeline pumps
- S Rotary drilling equipment

Conveyor systems
- M Hauling winches
- S Hoists
- M Link conveyors
- M Belt conveyors (bulk material)
- S Belt conveyors (piece goods)
- M Band pocket conveyors
- M Endless chain transporters
- M Rotary conveyors
- M Goods lifts
- G Bucket-type flour conveyors
- M Passenger lifts
- M Apron conveyors
- M Screw conveyors
- M Ballast elevators
- S Inclined hoists
- M Steel belt conveyors
- M Trough chain conveyors

Blowers, Ventilators
- G Rotary piston blowers $T_N \leq 75$ Nm
- M Rotary piston blowers $T_N \leq 750$ Nm
- S Rotary piston blowers $T_N > 750$ Nm
- G Blowers (axial/radial) $T_N \leq 75$ Nm
- M Blowers (axial/radial) $T_N \leq 750$ Nm
- S Blowers (axial/radial) $T_N > 750$ Nm
- G Cooling tower fans $T_N \leq 75$ Nm
- M Cooling tower fans $T_N \leq 750$ Nm
- S Cooling tower fans $T_N > 750$ Nm
- G Induced draught fans $T_N \leq 75$ Nm
- M Induced draught fans $T_N \leq 750$ Nm
- S Induced draught fans $T_N > 750$ Nm
- G Turbo blowers $T_N \leq 75$ Nm
- M Turbo blowers $T_N \leq 750$ Nm
- S Turbo blowers $T_N > 750$ Nm

Generators, transformers
- S Frequency transformers
- S Generators
- S Welding generators

Rubber processing machines
- S Extruders
- M Calenders
- S Pug mills
- M Mixers
- S Rolling mills

Wood working machines
- S Barkers
- M Planing machines
- G Wood working machines
- S Saw frames

Cranes
- G Luffing gear
- S Travelling gear
- S Hoisting gear
- M Slewing gear
- M Derricking jib gear

Plastics processing machines
- M Extruders
- M Calenders
- M Mixers
- M Crushers

Metal working machines
- M Sheet bending machines
- S Sheet straightening machines
- S Hammers
- S Planing machines
- S Presses
- M Shears
- S Forging presses
- S Punch presses
- G Countershafts, shaft trains
- M Machine tools, main drives
- G Machine tools, auxiliary drives

Food processing machines
- G Bottling and container filling machines
- M Kneading machines
- M Mash tubs, crystallizers
- G Packaging machines
- M Cane crushers
- M Cane knives
- S Cane mills
- M Sugar beet cutters
- M Sugar beet washing machines

Paper processing machines
- S Couches
- S Glazing cylinders
- S Pulpers
- S Pulp grinders
- S Calenders
- S Wet presses
- S Willows
- S Suction presses
- S Suction rolls
- S Drying cylinders

Pumps
- S Piston pumps
- G Centrifugal pumps (light liquids)
- M Centrifugal pumps (heavy liquids)
- S Plunger pumps
- S Pressure pumps

Stone and clay working machines
- S Crushers
- S Rotary kilns
- S Hammer mills
- S Ball mills
- S Tube mills
- S Beater mills
- S Brick presses

Textile machines
- M Batchers
- M Printing and dyeing machines
- M Tanning vats
- M Willows
- M Looms

Compressors
- S Piston compressors
- M Turbo compressors

Rolling mills
- S Sheet shears
- M Sheet tilters
- S Ingot pushers
- S Blooming and slabbing mills
- S Ingot conveying systems
- M Wire drawing benches
- S Descaling machines
- S Thin sheet mills
- S Heavy sheet mills
- M Winding machines (strip and wire)
- S Cold rolling mills
- M Chain transfers
- S Billet shears
- M Cooling beds
- M Cross transfers
- M Roller tables (light)
- S Roller tables (heavy)
- M Roller straighteners
- S Tube welding machines
- M Trimming shears
- S Cropping shears
- S Continuous casting plant
- M Roller adjustment drives
- S Shifting devices

Laundry machines
- M Tumble driers
- M Washing machines

Water treatment
- M Rotary aerators
- G Screw pumps

G = uniform load M = medium load S = heavy load

2. General notes

2.1 Introduction

These Operating Instructions (BA) are an integral part of the coupling delivery and must be kept in its vicinity for reference at all times.

Caution!

All persons involved in the installation, operation, maintenance and repair of the coupling must have read and understood these Operating Instructions and must comply with them at all times. We accept no responsibility for damage or disruption caused by disregard of these Instructions.

The **"Coupling"** described in these operating instructions has been developed for stationary use in general engineering applications. The coupling serves to transmit power and torque between two shafts or flanges connected by this coupling.

The coupling is designed only for the application described in section 1. "Technical data". Other operating conditions must be contractually agreed.

The coupling described in these Instructions reflects the state of technical development at the time these Instructions went to print.

In the interest of technical progress we reserve the right to make changes to the individual assemblies and accessories which we regard as necessary to preserve their essential characteristics and improve their efficiency and safety.

2.2 Copyright

The copyright to these Operating Instructions is held by **FLENDER AG.**

These Operating Instructions must not be wholly or partly reproduced for competitive purposes, used in any unauthorised way or made available to third parties without our agreement.

Technical enquiries should be addressed to the following works

FLENDER AG
D 46393 Bocholt

Telefon: 02871/92-2868
Telefax: 02871/92-2579

or to one of our customer-service addresses. A list of our customer-service addresses is given in section 11. "Spare parts, customer-service addresses".

3. Safety notes

3.1 Proper use

- The coupling has been manufactured in accordance with the state of the art and is delivered in a condition for safe and reliable use. Any changes on the part of the user which may affect safety and reliability are prohibited. This applies equally to safety features designed to prevent accidental contact.
- The coupling must be used and operated strictly in accordance with the conditions laid down in the contract governing performance and supply.

3.2 Obligations of the user

- The operator must ensure that all persons involved in installation, operation, maintenance and repair have read and understood these Operating Instructions and comply with them at all times in order to:

  – avoid injury or damage,

  – ensure the safety and reliability of the coupling,

  and

  – avoid disruptions and environmental damage through incorrect use.

- During transport, assembly, installation, dismantling, operation and maintenance of the unit, the relevant safety and environmental regulations must be complied with at all times.
- The coupling must be operated, maintained or repaired only by authorised, duly trained and qualified personnel.
- All work must be carried out with great care and with due regard to safety.
- All work on the coupling must be carried out only when it is at a standstill.
  The drive unit must be secured against being switched on accidentally (e.g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the ON switch stating clearly that work is in progress.
- The coupling must be fitted with suitable safeguards to prevent accidental contact. The operation of the coupling must not be impaired by the safeguard.
- The drive unit must be shut down as soon as changes to the coupling are detected during operation.
- If the coupling is intended for installation in plant or equipment, the manufacturer of such plant or equipment must ensure that the contents of the present Operating Instructions are incorporated in his own instructions.
- All spare parts must be obtained from FLENDER.

3.3 Warnings and symbols used in these Instructions

This symbol indicates safety measures which must be observed to avoid **personal injury.**

Caution! This symbol indicates safety measures which must be observed to avoid **damaging the coupling.**

Note: This symbol indicates general **operating instructions** which are of particular importance.

4. Handling and storage

4.1 Scope of supply

The products supplied are listed in the despatch papers. Check immediately on receipt to ensure that all the products listed have actually been delivered. Parts damaged during transport or missing parts must be reported in writing immediately.

The parts must be provided with explosion protection marking in accordance with section 5.

4.2 Handling

When handling FLENDER products, use only lifting and handling equipment of sufficient load-bearing capacity!

Note: The coupling must be transported using suitable transport equipment only.

Different forms of packaging may be used depending on the size of the coupling and method of transport. Unless otherwise agreed, the packaging complies with the **HPE Packaging Guidelines.**

The symbols marked on the packaging must be observed at all times. These have the following meanings:

bild-transport

4.3 Storage of the coupling

4.3.1 Storage of the coupling parts

Unless otherwise expressly agreed, the coupling is delivered in a preserved condition and can be stored in a covered, dry place for up to 3 months. If the coupling is to be stored for a protracted period, it should be treated with a long-term preservative agent (FLENDER must be consulted).

Caution! **Before cleaning the coupling parts and applying the long-term preservative agent, the flexible elements (12) must be removed.**

4.3.2 Storing the flexible elements

4.3.2.1 General

Correctly stored flexible elements (12) retain their properties unchanged for up to five years. Unfavourable storage conditions and improper treatment will negatively affect the physical properties of the flexible elements (12). Such negative effects may be caused by e.g. the action of ozone, extreme temperatures, light, moisture, or solvents.

4.3.2.2 Storage area

The storage area must be dry and free from dust. The flexible elements (12) must not be stored with chemicals, solvents, motor fuels, acids, etc. Furthermore, they should be protected against light, in particular direct sunlight and bright artificial light with a high ultraviolet content.

Caution! **The storage areas must not contain any ozone-generating equipment, e.g. fluorescent light sources, mercury vapour lamps, high-voltage electrical equipment. Damp storage areas are unsuitable. Ensure that no condensation occurs. The most favourable atmospheric humidity is below 65 %.**

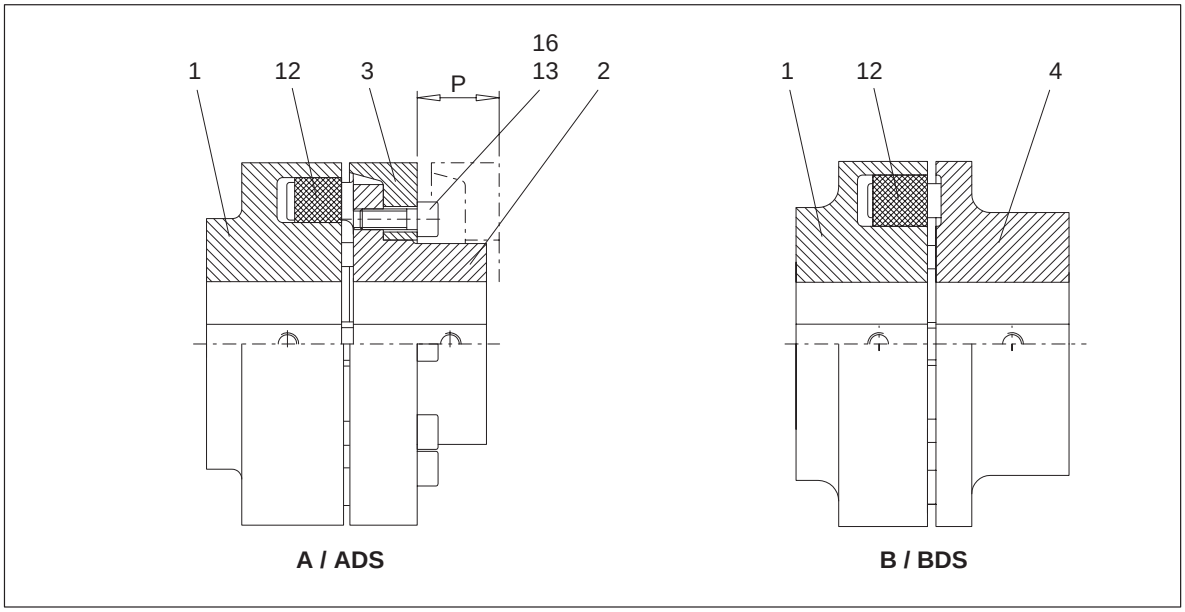
5. Technical description

5.1 General description

N-EUPEX couplings are torsionally flexible claw couplings. They are suitable for linking machines and can compensate for small shaft misalignment caused by manufacturing inaccuracies, heat expansion, and the like.

The N-EUPEX coupling Type A / ADS comprises the coupling part 1 with the inserted flexible elements (12), the cam part 3 and the coupling part 2 which is bolted to part 3. If dimension P in section 1 is taken into consideration, the screw connection of part 2/3 enables the machines to be connected to be disconnected without shifting them axially.
On Type A size 560 to 710 Part 2 and part 3 are additionally fastened with 2 parallel pins (16).

The N-EUPEX coupling Type B / BDS comprises the coupling part 1 with the inserted flexible elements (12) and the cam part 4.



Because of the form-fitting design of the metal parts, types A and B enable an ”emergency operation” even after the flexible elements have been irreparably damaged.
The flexible elements (12) are subjected primarily to pressure loads, so that the wear on the flexible elements (12) is relatively low with infrequent, substantial overload moments.

Where overload moments are excessively high, the result may be breakage of the coupling or irreparable damage to the connected machine.

On Types ADS and BDS there is no metal contact when the flexible elements (12) are irreparably damaged, and the metal parts are not of a form-fitting design. These coupling types have no ”emergency running capability” in the above described sense. The flexible elements (12) are subjected to shear and pressure loads, so that with substantial overload the flexible elements (12) are irreparably damaged and the torque transmission interrupted.

5.2 Flexible elements

As well as in standard hardness 80 Shore A, the H-shaped flexible elements (12) of Types A and B are also available in the softer 60 Shore A version.
This enables to move critical speeds of the drive train out of normal operating conditions.
When using these flexible elements (12), the reduction of the transmissible torque must be noted (see section 1. ”Technical Data”).
For reversing operation and drives with very high masses to accelerate and strong shock loads N-EUPEX couplings, Types A and B, may be fitted with higher flexible elements packs (12) with reduced torsional backlash.

The flexible elements (12) of Type ADS and BDS are available in 90 Shore A and 95 Shore A hardnesses.

The different flexible elements (12) are distinguished as follows:

Type	Size	Material	Hardness	Configuration	Identification marking
A, B	all sizes	Perbunan	80 Shore A	normal	blue stripe
	225 ... 480	Perbunan	60 Shore A	normal	green strip
	58 ... 200	Perbunan	80 Shore A	oversized	yellow stripe
	58 ... 200	Perbunan	60 Shore A	oversized	white stripe
ADS, BDS	all sizes	Polyurethan	90 Shore A	normal	blue flexible elements
	all sizes	Polyurethan	95 Shore A	normal	white flexible elements
	66 ... 272	Perbunan 2K	80/92 Shore A	normal	black flexible elements

Caution! **Only identical flexible elements (12) may be used in one coupling.**

6. Assembly

At the customer’s request FLENDER also delivers unbored or prebored coupling parts.

The necessary refinishing must be carried out in strict compliance with the following specifications and with particular care!

Caution! **Responsibility for carrying out the refinishing is borne by the orderer. FLENDER can accept no guarantee claims arising from unsatisfactory refinishing!**

6.1 Instructions for machining the finished bore, parallel keyway, axial retaining means, set screws and balancing

6.1.1 Finish bore

- Remove flexible elements
- Depreserve and, if necessary, clean coupling parts

Note manufacturer’s instructions for handling solvent.

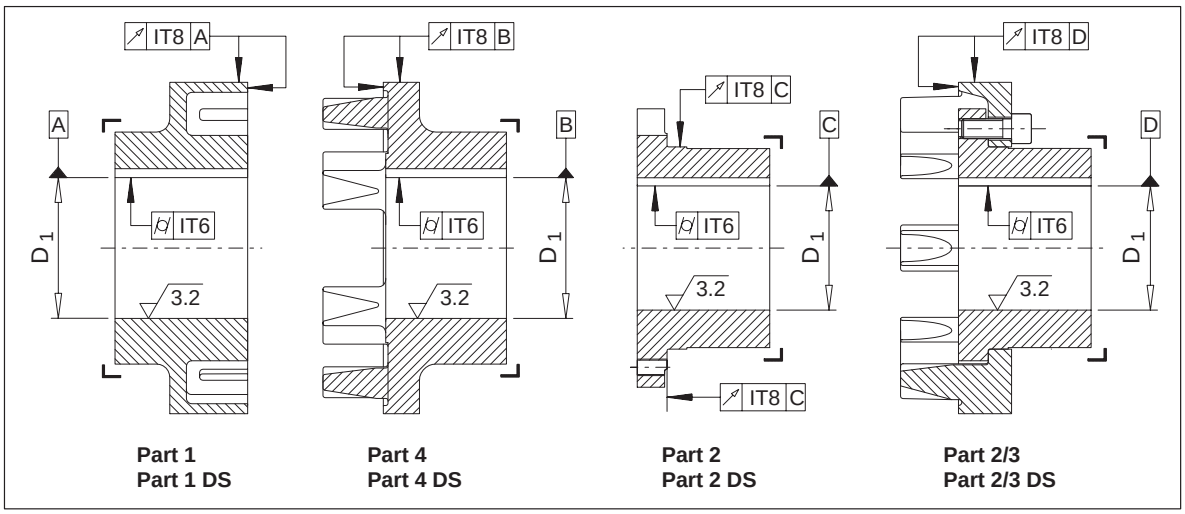
When machining the finished bore the parts must be carefully aligned. For the permissible radial and axial runout errors and the permissible cylindricity tolerances, refer to DIN ISO 286. The parts must be mounted on the marked faces (⌜).

In the case of part 2/3 and part 4 great caution is necessary owing to the rotating cams.

Caution!

The maximum permissible bore diameters (see section 1.) are designed for drive-type fastenings without taper action to DIN 6885/1 and must not under any circumstances be exceeded. The finish-machined bores must be 100% checked with suitable measuring equipment.

If other shaft - hub connections (e.g. taper or stepped bore, etc.) are to be used instead of the flanged sleeve connections provided for, FLENDER must be consulted.
Flanged sleeve connections with taper action are not permissible.



For drive by means of parallel keys the following fit pairs are prescribed for the bores:

Selection of fit	Bore D_1 over mm	Bore D_1 to mm	Shaft tolerances	Bore tolerances
Shaft tolerances to FLENDER standard		25	k6	H7
	25	100	m6	
	100		n6	
Shaft tolerances to DIN 748/1		50	k6	H7
	50		m6	
System standard shaft		50	h6	K7
	50			M7
	all		h8	N7

Table 6.1.1: Fit pairs

Caution!

The assigned fits must be adhered to in order, on the one hand, to keep the play in the shaft-hub connection as low as possible, depending on utilisation of the tolerance zones, or, on the other, to keep the hub tension arising from the oversize within the permissible load limit. Failure to adhere to the fits may impair the shaft-hub connection.
If the tolerance values of the shafts deviate from those in table 6.1.1 above, FLENDER must be consulted.

Failure to observe these instructions may result in breakage of the coupling. Danger from flying fragments!

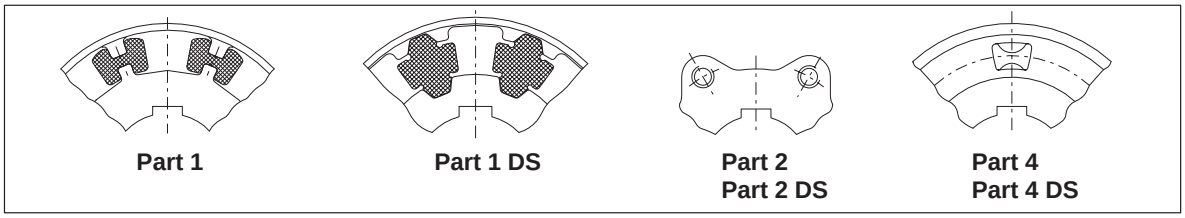
6.1.2 Parallel keyway

The parallel keyways must be designed in accordance with DIN 6885/1. If the keyway geometry deviates, FLENDER must be consulted. Taper keys or nose keys (gib headed keys) are not permissible.

The parallel keyways must be designed to suit the available parallel keys. For parallel keyways the tolerance zone of the hub keyway width **ISO JS 9** must be adhered to.

For **more difficult operating conditions** of the kind arising e.g. with reversing operation or operation with impulses the hub keyway tolerance zone **ISO P9** is specified.

Caution! **On part 1 the parallel keyway must be applied midway between the lands or pockets of the flexible elements, on part 2 midway between the through-holes and on part 4 below a cam.**



6.1.3 Axial securing device

A set screw or end plate must be provided to secure the coupling parts axially. If end plates are used, FLENDER must be consulted with regard to machining the recesses in the coupling parts.

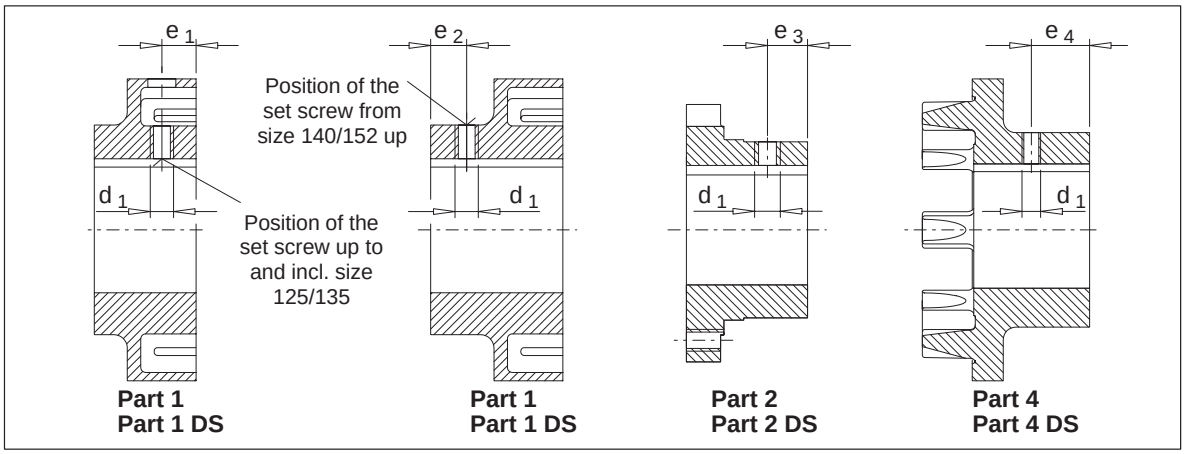
If the coupling part mounted on the shaft does not lie up against the shaft shoulder, we recommend using grooved spacer rings.

6.1.4 Set screws

Hexagon socket set screws with cup points to DIN 916 must be used for set screws.

The following guidelines must be observed!

⚠ **The length of the set screw must be selected so that it fills the tapped hole, but does not project from the hub ($L_{min} = d_1 \times 1.2$).**



Size	58	68	80	95	110	125	140	160	180	200	225	250	280	315	350	400	440	480	520	560	610	660	710
	66	76	88	103	118	135	152	172	194	218	245	272	305	340	380	430	472	514	556	–	–	–	–
d_1	M5	M6	M6	M6	M6	M8	M8	M10	M12	M12	M12	M16	M16	M16	M20	M20	M24	M24	M24	M24	M24	M24	M24
e_1	*10	*10	*11	*15	18	20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
e_2	–	–	–	–	–	–	13	13	16	20	22	24	28	35	40	50	60	70	80	75	85	100	115
e_3	–	–	–	–	*9	12	15	20	30	30	35	40	45	50	60	70	80	90	100	100	110	130	140
e_4	*8	*8	12	15	18	20	22	25	32	40	40	45	45	–	–	–	–	–	–	–	–	–	–
1)	3	4	4	4	4	8	8	15	25	25	25	70	70	70	130	130	230	230	230	230	230	230	230

Table 6.1.4: Set screw assignment and tightening torques of the set screws

1) Tightening torques of the set screws in Nm

*) Note following position of the set screw!

Caution! **The set screws must always be positioned on the keyway. An exception are the following coupling parts:**

Part 1: Size 58 / 66 : Bore $D_1 \geq$ 15 mm set screw displaced by 180° relative to the keyway.
Size 68 / 76 : Bore $D_1 \geq$ 20 mm set screw displaced by 144° relative to the keyway.
Size 80 / 88 : Bore $D_1 \geq$ 25 mm set screw displaced by 180° relative to the keyway.
Size 95 /103 : Bore $D_1 \geq$ 38 mm set screw displaced by 180° relative to the keyway.

Part 2: Size 110 /118 : Bore $D_1 \geq$ 30 mm set screw displaced by 180° relative to the keyway.

Part 4: Size 58 / 66 : Bore $D_1 \geq$ 18 mm set screw displaced by 180° relative to the keyway.
Size 68 / 76 : Bore $D_1 \geq$ 20 mm set screw displaced by 180° relative to the keyway.

6.1.5 Balancing

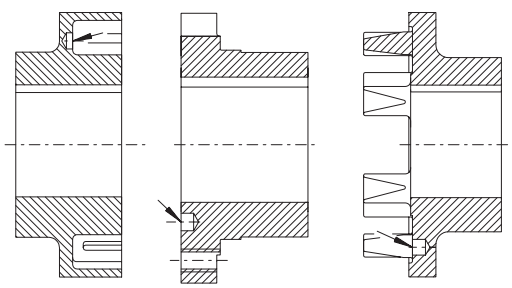
Prebored couplings or prebored coupling parts are delivered unbalanced. It is recommended that these parts are balanced to suit the application after finish-boring (see DIN ISO 1940 and DIN 740/2), but to min. balancing quality G16.

Balancing is normally done by drilling material away.

Caution! **On part 1 the material must be removed between the lands or pockets of the flexible elements without drilling right through the base and without damaging the pockets of the flexible elements.**
On part 4 the material must be removed from the end face between the cams. Sufficient space must be left between the balancing hole and the cam to avoid weakening the cam connection.

Since the coupling part 3, the cam part is always in a balanced condition, the coupling part 2 can be balanced individually or together with the fitted part 3.

Finish-bored couplings or coupling parts are balanced according to the customer's specifications.

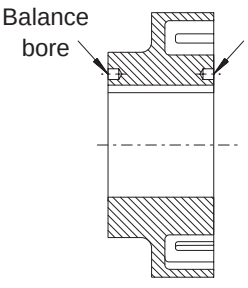


Part 1
Part 1 DS

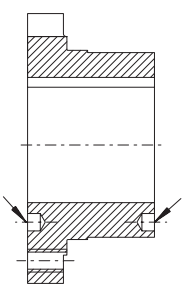
Part 2
Part 2 DS

Part 4
Part 4 DS

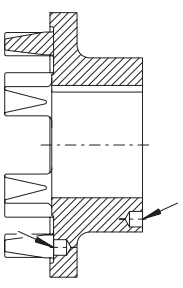
Arrangement of the balancing bore with one-level balancing



Part 1
Part 1 DS



Part 2
Part 2 DS



Part 4
Part 4 DS

Arrangement of the balancing bore with two-level balancing

6.2 General information on installation

During assembly, Section 3. ”Safety Instructions” must be observed.

Assembly and installation work must be done with great care by trained and qualified personnel.

As early as during the planning phase it must be ensured that sufficient space is available for installation and subsequent care and maintenance work.

Adequate lifting equipment must be available before beginning the installation and assembly work.

6.3 Mounting the coupling parts

Before beginning installation, the shaft ends and the coupling parts must be carefully cleaned. Before cleaning the coupling parts with solvent the flexible elements (12) must be removed.

Note manufacturer’s instructions for handling solvent.

Before fitting coupling part 2 the cam part 3 must be located on the shaft.

If necessary, heating the coupling parts (to max. +150 °C) will facilitate fitting. With temperatures over +80 °C the flexible elements (12) must be removed from the coupling parts before heating.

Take precautions to avoid burns from hot components!

Caution! **The coupling parts must be fitted with the aid of suitable equipment to avoid damaging the shaft bearings through axial joining forces.**
Always use suitable lifting equipment.

The shaft ends must not project from the inner sides of the hub. Axial securing is effected by means of the set screw or end plate.

Caution! **Tightening the set screws to a tightening torque in accordance with item 6.1.4.**

Failure to observe these instructions may result in breakage of the coupling.
Danger from flying fragments!

After fitting the coupling parts, the flexible elements (12), if previously removed, must be fitted. Previously heated coupling parts must have cooled down again to a temperature below +80 °C. It must be ensured that the flexible elements (12) are of identical size and have identical markings.

Move together the machines to be coupled.

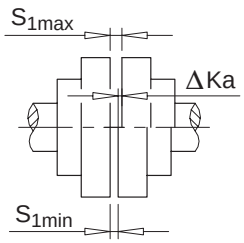
Danger of squeezing!

Dimension S_1 must be adhered to. On Types A and ADS the connection between parts 2 and 3 must be remade and the tightening torque of the screw connection to parts 2 and 3 checked before alignment (for tightening torques and gap dimension S_1, see item 6.6 and section 1.).

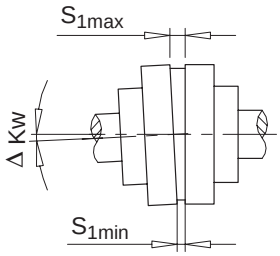
6.4 Alignment

The couplings pick up positional errors in the shaft ends to be connected up to the data shown in item 6.5.
When aligning, the radial and angular misalignment of the shaft ends must be kept as small as possible, because, other conditions being equal, this increases the service life of the flexible elements.

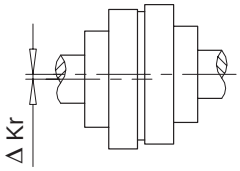
6.5 Possible misalignments



Axial misalignment
Figure 6.5.1



Angular misalignment
Figure 6.5.2



Radial misalignment
Figure 6.5.3

Misalignments of the coupling parts in relation to each other can be caused by inaccurate alignment during assembly, but also by actual operation of the equipment (expansion due to heat, shaft deflection, insufficiently rigid machine frames, etc.).

Caution! **The following maximum permissible misalignments must by no means be exceeded during operation.**

6.5.1 Axial misalignment

Axial misalignment ΔKa (Fig. 6.5.1) of the coupling parts relative to one another is possible within the "permissible error" for dimension S_1 (see section 1.).

6.5.2 Angular misalignment

The angular misalignment ΔKw (Fig. 6.5.2) can usefully be measured as the difference in the gap dimension ($\Delta S_1 = S_{1max} - S_{1min}$). For the permissible values for the difference in the gap dimension, refer to item 6.5.4.

If required, the permissible angular misalignment ΔKw can be calculated as follows:

$$\Delta Kw_{perm} \text{ in Rad} = \frac{\Delta S_{1\,perm}}{d_a}$$

$$\Delta Kw_{perm} \text{ in Degrees} = \frac{180}{\pi} \times \frac{\Delta S_{1\,perm}}{d_a}$$

$\Delta S_{1\,perm.}$ see item 6.5.4

for d_a, see section 1., item 1.1.1 or item 1.2.1

6.5.3 Radial misalignment

For the permissible radial misalignment $\Delta Kr_{perm.}$ (Fig. 6.5.3), - depending upon the operating speed -, refer to item 6.5.4.

6.5.4 Permissible shaft misalignment values for radial misalignment $\Delta Kr_{perm.}$ and difference in gap dimension ΔS_{1perm}

Values given in mm, rounded off

Type / Size		Coupling speed in 1/min								
A, B	ADS, BDS	250	500	750	1000	1500	2000	3000	4000	5000
58	66	0.4	0.3	0.25	0.2	0.2	0.15	0.15	0.1	0.1
68	76	0.4	0.3	0.25	0.2	0.2	0.15	0.15	0.1	0.1
80	88	0.4	0.3	0.25	0.2	0.2	0.15	0.15	0.1	0.1
95	103	0.5	0.35	0.25	0.25	0.2	0.2	0.15	0.1	0.1
110	118	0.5	0.35	0.3	0.25	0.2	0.2	0.15	0.1	0.1
125	135	0.5	0.4	0.3	0.25	0.25	0.2	0.15	0.15	0.1
140	152	0.6	0.4	0.35	0.3	0.25	0.2	0.2	0.15	
160	172	0.6	0.5	0.4	0.35	0.3	0.25	0.2	0.15	
180	194	0.6	0.5	0.4	0.35	0.3	0.25	0.2		
200	218	0.8	0.55	0.45	0.4	0.3	0.3	0.2		
225	245	0.8	0.55	0.5	0.4	0.35	0.3	0.25		
250	272	0.8	0.6	0.5	0.4	0.35	0.3			
280	305	1	0.7	0.6	0.5	0.4	0.35			
315	340	1	0.7	0.6	0.5	0.4	0.35			
350	380	1	0.8	0.6	0.6	0.5				
400	430	1.2	0.9	0.7	0.6	0.5				
440	472	1.3	1	0.7	0.7	0.6				
480	514	1.4	1	0.8	0.7					
520	556	1.5	1.1	0.9	0.8					
560		1.6	1.2	1	0.8					
610		1.8	1.3	1	0.9					
660		1.9	1.4	1.1	1					
710		2	1.5	1.2						

The numerical values of the table can be calculated as follows:

$$\Delta Kr_{perm} = \Delta S_{1\,perm} = \left(0.1 + \frac{d_a}{1000}\right) \times \frac{40}{\sqrt{n}}$$

Coupling speed n in 1/min

Coupling size designation d_a in mm (see section 1, item 1.1.1 or item 1.2.1)

Radial misalignment Kr_{perm} in mm

Caution! **Angular and radial misalignment may occur simultaneously.**

6.6 Tightening torques

N-EUPEX Coupling	**N-EUPEX-DS Coupling**	Tightening torque T_A and spanner size S_W for hexagon socket screws to DIN EN ISO 4762	
		T_A	**S_W**
Size	**Size**	Nm	mm
110	**118**	14	6
125	**135**	17.5	6
140	**152**	29	8
160	**172**	35	8
180	**194**	44	8

200	**218**	67.5	10
225	**245**	86	10
250	**272**	145	14
280	**305**	185	14
315	**340**	200	14
350	**380**	260	17
400	**430**	340	17
440	**472**	410	17
480	**514**	550	19
520	**556**	670	19
560		710	19
610		1450	22
660		1450	22
710		1450	22

Table 6.6: Tightening torques for part 13 of Types A and ADS

Note: Tightening torques apply to screws with untreated surfaces which are not or only lightly oiled (coefficient of friction $\mu = 0.14$). The use of lubricant paint or the like, which affects the coefficient of friction μ, is not permitted.

Note: The tightening torques of the set screws are specified in item 6.1.4.

7. Start-up

7.1 Procedure before start-up

Before starting up check the flexible elements (12) for correct seating, i.e. the flexible elements (12) must sit flush with the end face of the hub, and the set screws for tightness, check and, if necessary, adjust the alignment and the gap dimension S_1 and check all screw connections for the specified tightening torques (see section 6.).

Then fit the coupling guard to prevent unintentional contact.

8. Operation

8.1 General operating data

During operation of the coupling watch for:

– changes in running noise

– sudden shocks

Caution!

If any irregularities are noticed during operation, switch the drive assembly off at once. Determine the cause of the fault, using the table in section 9.
This table contains a list of possible faults, their causes and suggested remedies.
If the cause cannot be identified or the unit repaired with the facilities available, you are advised to contact one of our customer-service offices for specialist assistance (see section 11.).

9. Faults, causes and remedy

9.1 General

The following irregularities can serve as a guide for fault tracing.

Where the system is a complex one, all the other component units must be included when tracing faults.

The coupling must run with little noise and without vibration in all operating phases. Irregular behaviour must be treated as a fault requiring immediate remedy.

Caution!

FLENDER will not be bound by the terms of the guarantee or otherwise be responsible in cases of improper use of the coupling, modifications carried out without FLENDER's agreement, or use of spare parts not supplied by FLENDER.

When remedying faults and malfunctions, the coupling must always be taken out of service.
Secure the drive unit to prevent it from being started up unintentionally.
Attach a warning notice to the start switch.

9.2 Possible faults

Malfunctions	Causes	Remedy
Sudden changes in the noise level and/or sudden vibrations	Change of alignment	take the system out of service if necessary, rectify causes of alignment change (e.g. tighten loose foundation bolts) Check and, if necessary, adjust alignment (see section 6). Wear check, procedure as described in section 10
	Flexible elements (12) worn	take the system out of service Demount coupling and remove remains of flexible elements (12) Check and replace damaged coupling parts Flexible elements (12) must be changed in sets; use only identical N-EUPEX flexible elements (12) Assembly of coupling according to section 6. and section 7.

Table 9.2: Possible faults

9.3 Incorrect use

Experience has shown that the following faults can result in incorrect use of the N-EUPEX coupling. In addition to observing the other instructions in this BA, care must therefore be taken to avoid these faults.

Failure to observe these instructions may result in breakage of the coupling. Danger from flying fragments!

Caution! **Incorrect use of the N-EUPEX coupling may result in damage to the coupling.**

Caution! **Coupling damage may result in stoppage of the drive and the entire system.**

9.3.1 Possible faults when selecting the coupling or coupling size

- Important information for describing the drive and the environment will not be communicated to others
- System torque too high
- System speed too high
- Application factor not correctly selected
- Chemically aggressive environment not taken into consideration
- The ambient temperature is not permissible. See also section 1.
- Finished bore with impermissible diameter (see section 1) and/or impermissible fit classification (see section 6.)
- The transmission capacity of the shaft-hub connection is not appropriate to the operating conditions

9.3.2 Possible faults when installing the coupling

- Components with transport or other damage are being fitted
- When mounting coupling parts in a heated condition, already mounted N-EUPEX flexible elements (12) are being excessively heated
- The shaft diameter is outside the specified tolerance range
- Coupling parts are being interchanged, i.e. their assignment to the specified shaft is incorrect
- Prescribed tightening torques are not being adhered to
- Alignment or shaft misalignment values do not match the operating instructions
- The coupled machines are not correctly fastened to the foundation, so a shifting of the machines e.g. through loosening of the foundation screw connection is causing excessive displacement of the coupling parts
- N-EUPEX flexible elements (12) are being omitted or incorrectly positioned
- Operating instructions are being changed without authorisation

9.3.3 Possible faults in maintenance

- Maintenance intervals are not being adhered to
- Original FLENDER N-EUPEX flexible elements (12) are not being used
- Old or damaged N-EUPEX flexible elements (12) are being used
- Different N-EUPEX flexible elements (12) are being used (see section 5.)
- Leakage in the vicinity of the coupling is not being identified and as a result chemically aggressive media are damaging the coupling

10. Maintenance and repair

All work on the coupling must be carried out only when it is at a standstill. The drive unit must be secured against being switched on accidentally (e.g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the ON switch stating clearly that work is in progress.

10.1 Maintenance interval

On Types A and B the torsional backlash between the two coupling parts must be checked after three months, then at least once a year.
In the case of types ADS and BDS checking the torsional backlash at regular intervals is recommended in terms of preventive maintenance.

If an increased coupling backlash does not impair the operation of the coupling, the flexible elements (12) can continue to be used up to a specified wear limit before being replaced. To assess wear, the permitted circumferential backlash, converted to the chord dimension ΔS_V on the outer coupling diameter, is shown in table 10.1a. and table 10.1b. To obtain the dimension ΔS_V, one coupling part is rotated without torque as far as the stop and a mark applied to a coupling part (see Fig. 10.1). If the coupling part is rotated in the opposite direction of rotation as far as the stop, the marks move apart. The distance between the marks is the chord dimension ΔS_V. If the dimension ΔS_V exceeds the value in table 10.1a or table 10.1b, the flexible elements (12) must be replaced.

Caution! **The flexible elements (12) must be replaced in sets.**
Only identically marked flexible elements (12) must be used.

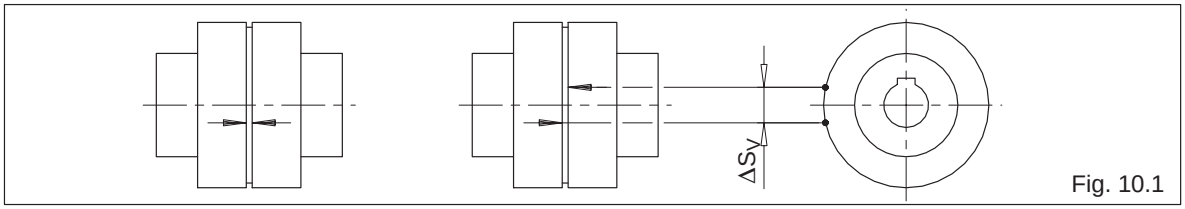


Fig. 10.1

Size	58	68	80	95	110	125	140	160	180	200	225	250	280	315	350	400	440	480	520	560	610	660	710
Wear mark ΔS_V (mm)	5.5	5.5	5.0	6.0	7.0	8.0	8.0	8.0	8.0	8.5	9.0	10.0	11.5	10.5	11.5	13.0	14.0	15.5	17.5	17.5	19.5	21.0	22.5

Table 10.1 a: Wear mark of N-EUPEX coupling

Size	66	76	88	103	118	135	152	172	194	218	245	272	305	340	380	430	472	514	556
Wear mark ΔS_V (mm)	6.0	7.0	5.0	7.0	9.0	10.5	11.5	9.0	8.0	7.0	6.5	7.0	8.0	6.5	7.0	10.0	12.0	14.0	16.0

Table 10.1 b : Wear mark of the N-EUPEX-DS coupling

10.2 Replacement of wearing parts

Only **original N-EUPEX flexible elements** must be used for replacement to guarantee troublefree torque transmission and faultfree operation.

Note: Replacement of the flexible elements (12) is possible without shifting the coupled machines only on Types A and ADS.

After releasing the connection of parts 2 and 3, part 3 is shifted axially. The flexible elements (12) will then be made freely accessible by rotating part 2. To facilitate the release of part 3, on sizes 225 - 430 forcing-off threads are provided in part 1. From size 440 up the forcing-off threads are located in part 3 (see Figures 10.2 a and 10.2 b).

Fig. 10.2 a

Fig. 10.2 b

For re-assembly, the instructions in section 6. ”Assembly” and section 7. ”Start-up” must be carefully observed.

11. Spare parts, customer-service addresses

By stocking the most important spare and wearing parts on site, you can ensure that the coupling is ready for use at any time.

When ordering spare parts, always state the following:

– Original order no.

– Part no. (see item 11.1)

– Specification / size (the size designation corresponds to the outside diameter da in mm)

– Quantity

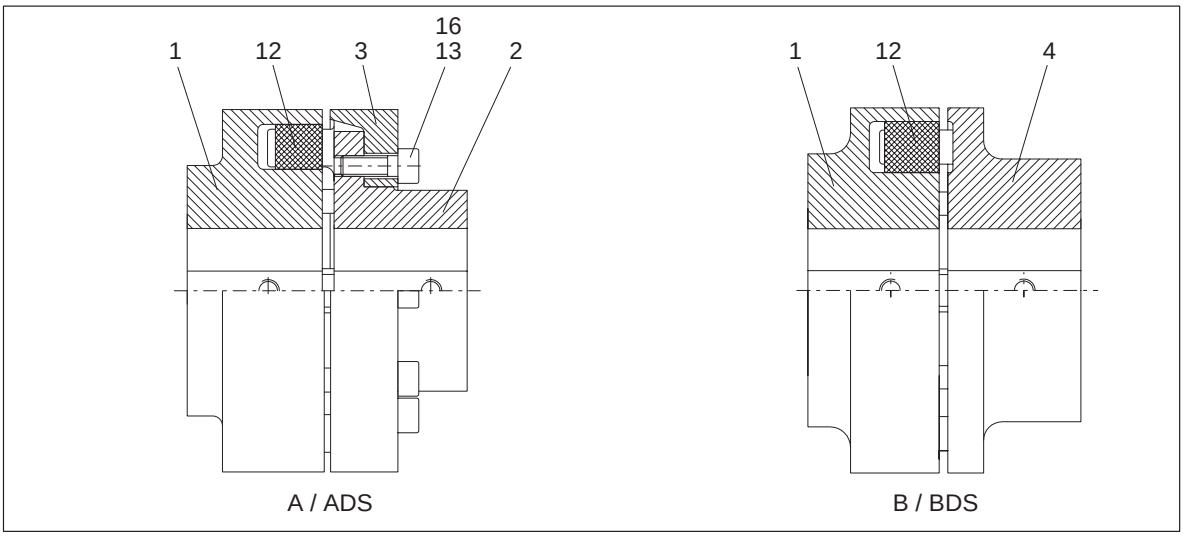
We guarantee only the original spare parts supplied by us.

Caution!

Please note that spare parts and accessories not supplied by us have not been tested or approved by us. The installation or use of such products may therefore impair essential characteristics of the coupling under certain circumstances and so pose an active or passive hazard. FLENDER will assume no liability or guarantee for damage caused by spare parts and accessories not supplied by FLENDER.

Please note that certain components often have special production and supply specifications and that we supply you with spare parts which comply fully with the current state of technical development as well as current legislation.

11.1 Spare parts list



Spare parts Type A, ADS		Spare parts Type B, BDS	
Part no.	Description	Part no.	Description
1	Part 1	1	Part 1
2	Part 2	4	Part 4
3	Part 3	12	Flexible elements
12	Flexible elements		
13	Cheese head screw		
16	Parallel pin only on Type A Size 560 to 710		

Table 11.1: Spare parts list, Types A, ADS, B and BDS

11.2 Spare-part and customer service addresses

When ordering spare parts or requesting the services of our specialist engineers, please apply first to FLENDER AG.

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12. Declaration by the manufacturer

Declaration by the manufacturer

in accordance with EC Engineering Guideline 98/37/EC, Appendix II B

We hereby declare that the

Flexible **N-EUPEX** and **N-EUPEX-DS** couplings
Types **A, B** and **ADS, BDS**

described in these Operating Instructions are intended for incorporation in a machine, and that it is prohibited to put them into service before verifying that the machine into which they are incorporated complies with the EC Guidelines (original edition 98/37/EC including any subsequent amendments thereto).

This Manufacturer's Declaration takes into account all the unified standards (inasmuch as they apply to our products) published by the European Commission in the Official Journal of the European Community.

Bocholt, 2003-07-10

Signature (person responible for products)